PROJECT MANUAL

BID-SJR-2011-07

RENOVATIONS TO BUILDINGS S & V
ORANGE PARK CAMPUS
for
ST. JOHNS RIVER STATE COLLEGE
ORANGE PARK, FLORIDA

CRG ARCHITECTS/PALATKA, INC.
216A ST. JOHNS AVENUE / P. O. BOX 1863
PALATKA, FL 32177 • TEL: 386-325-0213

JOB NO. 015J03

RENOVATIONS TO BUILDINGS S & V
ORANGE PARK CAMPUS

for

ST. JOHNS RIVER STATE COLLEGE
5001 ST. JOHNS AVENUE, PALATKA, FLORIDA 32177

BID-SJRCC-2011-07
ARCHITECT'S JOB NO. 015J03

ARCHITECTS

CRG Architects/Palatka, Inc.
216A St. Johns Avenue
Palatka, Florida 32177
Tel: (386) 325-0213
Fax: (386) 328-1401

STRUCTURAL ENGINEERING

Southard Engineering, Inc.
4566B NW 5th Boulevard
Gainesville, FL 32609
Tel: (352)-367-2526
Fax: (352)-367-2526

MECHANICAL & ELECTRICAL ENGINEERING

OCI Associates, Inc.
427 Centerpointe Circle, Suite 1825
Tel: (407) 332-5110
Fax: (407-332-7704

Statement of Compliance: To the best of my knowledge, this Project Manual is complete and complies with the State Requirements for Educational Facilities, latest edition.

_____

Robert C. Goodwin, AIA AR0003044

OCTOBER 19, 2011

TABLE OF CONTENTS

The General Contractor shall be required to compare this Table of Contents with the bound Project Manual for legibility, omission or inclusion of any part of any section listed herein. It shall be the General Contractor's responsibility to request, in writing, clarification from the office of the Architect. Clarifications shall be addressed by addenda to all who are registered with the Architect as having received Bidding documents. *All clarifications shall be received fourteen (14) calendar days prior to the date set for the receipt of Bids.*

The General Contractor and Subcontractors shall review other sections of work applicable to their work and ascertain requirements in other sections applicable to their work. Each shall be held responsible for coordination and inclusion of the work indicated as if it were in the particular subcontractor's section. All subcontractors, suppliers, etc., shall be responsible for knowing what information is given on all sheets of the plans and specifications concerning his particular work.

END OF TABLE

SECTION 00020

INVITATION TO BID

1.01 INVITATION TO BIDDERS

A. Sealed bids will be received in the office of the Director of Purchasing and Contract Administration at St. Johns River State College, Palatka, Florida for the Renovations to Buildings S & V, SJR State College, Orange Park Campus, Orange Park, Florida

BID NO.: BID-SJR-2011-07

RENOVATIONS TO BUILDINGS S & V
ORANGE PARK CAMPUS
For
ST JOHNS RIVER STATE COLLEGE
5001 ST. JOHNS AVENUE
PALATKA, FLORIDA 32177

1.02 BIDS

A. Bids will be received at the Business Office of St. Johns River State College, 5001 St. Johns Avenue, Palatka, Florida, until:

LOCAL TIME: **2:00 P.M.**
DAY OF WEEK: **Friday**
DATE: **December 2, 2011**

The bids will then be publicly opened at **2:30 p.m.**, read aloud, and recorded in the **Administration Building, Room A-154, SJR State College, Palatka Campus , 5001 St. Johns Avenue, Palatka, Florida**

1.03 BIDDING DOCUMENTS

A. The Contract Documents for bidding may be examined and obtained at the office of the Design Professional:

CRG ARCHITECTS/PALATKA, INC.
216A ST. JOHNS AVENUE
PALATKA, FLORIDA 32177
TEL: 386/325-0213
FAX: 386/328-1401

B. The Contract Documents may be examined but not obtained at:

Construction Bulletin, Jacksonville
McGraw Hill Construction Dodge, Jacksonville
Reed Construction Data, Jacksonville

C. General: Bidding Documents, in whole, are available at the Design Professional's Office upon receipt of checks or money orders made payable to CRG Architects for the total required amount. **Payments for deposit item shall be separate from shipping charges. Do not combine payment**.

1. Request for billing will not be honored. Cash or check will be accepted.

D. Bidding Document Cost: Shipping charges are in addition to below stated amounts:

ITEM	NON-REFUNDABLE DEPOSIT/EACH
Complete Set Bidding Documents	$ 50.00
Shipping Charges (per set)	$ 12.00

E. Distribution:

1. Bidders: Pre-Qualified General Contractors are eligible for two (2) sets of bidding documents upon payment of a refundable deposit for each. Additional copies are available on non-refundable cost basis. **Shipping charges are in addition thereto.**

2. Major sub-bidders and major material suppliers: Eligible for one (1) set of bidding documents upon payment of a refundable deposit. Additional copies are available on a non-refundable cost basis. **Shipping charges are in addition thereto.**

3. Sub-bidders, product suppliers and other interested parties: Eligible for bidding documents upon payment of non-refundable deposit and shipping cost as applicable. **No partial sets will be distributed.**

F. Return of Bidding Documents: Documents, regardless of method of procurement, remain the property of the Design Professional and shall be issued for no other purpose other than bidding on or constructing this project. Bidding documents shall be returned *complete, bound, in original order, intact and within (14) days after receipt of bids.*

1.04 BONDS

A. The successful contractor is required to furnish Performance and Payment Bonds described in the Contract Documents.

B. Bid guarantee in the form of a Bid Bond executed by the bidder and a qualified surety or a certified or cashier's check on any national or state bank in the amount of five percent (5%) of the proposal, including alternates, made payable to St. Johns River State College, must accompany competition after opening bids, and in the event contract is awarded to the bidder, will, within ten (10) days after receiving same, execute contract and furnish the required bond, failing which the security shall become the property of the Board of Trustees as liquidated damages.

1.05 PREPARATION AND SUBMISSION OF PROPOSAL

A. All bids must be made on Proposal Forms, included herein, properly executed and placed in envelopes and marked:

RENOVATIONS TO BUILDINGS S & V, ORANGE PARK CAMPUS
BID-SJR-2011-07

Deliver or mail to: Office of the Director of Purchasing & Contract Administration - Room A-10
Administration Building
St. Johns River State College
5001 St. Johns Avenue
Palatka, Florida 32177

B. St. Johns River State College reserves the right to reject any or all bids, waive informalities in any bid, make the award in part or whole and to make the award in the best interest of St. Johns River State College. It is the intention of St. Johns River State College to award a contract to a single qualified Bidder submitting the lowest total base bid and for any bid alternate proposals contingent upon availability of funding.

C. No changes in the amounts of bids appearing on the outside of bids will be considered. Only the amounts shown inside the envelope will be considered. All changes, corrections and erasures must be initialed by the person signing the bid.

D. Furnish with your bid the satisfaction of your proper licensing.

E. There will be a **Mandatory Pre-Bid Conference** to be held on **November 1, 2011** at **2:00 p.m.** in **Suite E, Thrasher-Horne Center at St. Johns River State College**, **283 College Drive, Orange Park**. Bidders or their representatives are **required** to attend in order to be eligible to bid.

F. **This project is limited to Pre-Qualified Bidders only**. Only those bids by Pre-Qualified General Contractors will be considered.

END OF SECTION

SECTION 00101

INSTRUCTIONS TO BIDDERS

A. BID DATE:

Sealed proposals will be received by the St. Johns River State College Board of Trustees at the date, time and place so stated in the "Invitation to Bid" for all work herein. The bidder or his authorized representative is invited to be present at the bid opening.

B. PROJECT SITE LOCATION:

ST. JOHNS RIVER STATE COLLEGE, ORANGE PARK CAMPUS
ORANGE PARK, FLORIDA

C. PROPOSALS:

All work on the project shall be included in the proposal for the General Construction. Proposals for bid items for this project shall be submitted *in duplicate* on the proposal form enclosed in this project manual. The proposal shall be sealed in an envelope and marked to indicate the project name, bid number and contractor's name. The envelope shall then be forwarded or delivered to the Office of the Director of Purchasing and Contract Administration, in the Administration Building at St. Johns River State College, Palatka, Florida.

1. The bidder shall fill in their proposal completely and correctly sign the proposal. Proposals that show any omissions, alterations of the proposal, additions not authorized by the St. Johns River State College Board, conditional bids, or irregularities of any kind, may be rejected.

2. Proposals shall be submitted in sufficient time for receipt by the St. Johns River State College, prior to scheduled hour for receipt of the proposals. Bids received after the scheduled bid date and time will not be considered. No changes will be permitted after bids have been submitted. All bidders shall be notified of the bid results.

3. No proposals may be withdrawn, after the schedule closing time for bids, for a period of sixty (60) days.

4. It is the intention of the St. Johns River State College Board of Trustees to award a contract to a single bidder submitting the lowest proposal for the work. However, the Board reserves the right to reject any or all bids, to accept any bid submitted, to waive any informalities, and to negotiate with the low bidder or bidders on any changes which the Board considers necessary for their own interests, including but not limited to direct purchase of materials.

D. Completion:

Time of completion for this project is a condition of the contract and as such is not flexible. The time of completion is indicated in the specifications and no extension of time is anticipated. If the bidder cannot meet the construction schedule, they should not submit a bid.

E. Contractor's License: All bidders shall be licensed as required by the State of Florida laws.

F. Site Investigation:

Each bidder shall, before submitting their proposal, examine the sites to determine the extent of the work involved and the conditions under which they must perform the work.

The submittal of a proposal will be construed as evidence that such examination has been made and no subsequent allowance will be made in this connection.

G. Permits, Fees and Taxes:

Cost of social security and other applicable state and federal government taxes and any sales taxes for which the bidder is liable shall be included in his proposal for the work. No local building permits are required for work on the campus. The College will issue the General Building Permit.

H. Performance and Payment Bond:

The successful bidder shall furnish a satisfactory performance and payment bond with a corporate surety authorized to do business in the State of Florida and acceptable to the College, within ten (10) days after notice of award. The bond shall be conditioned well and truly to perform the contract and pay all bills and invoices, for labor done and materials furnished in the performance of the work including guarantee period of one (1) year against faulty work, and be on **AIA Document Form A312.**

1. All bonds must be executed under corporate seal of the surety and countersigned on the part of the surety by a qualified resident agent of the company or an attorney in fact with proof of power attached.

2. In case of default on the part of the contractor, actions for all expenses incident to ascertaining and collecting losses under the bond including both architectural and legal services shall lie against bond.

3. Such bond shall be in the penal sum of 100% of the contract.

4. Premiums for the performance and payment bond shall be included in the bidder's proposal.

I. Bid Security:

Bid security will be required in an amount not less than five percent (5%) of the base bid amount and all alternates, in the form indicated in Section 00020, Invitation to Bid.

J. Interpretation of Drawings and Specifications:

Should a bidder find discrepancies or ambiguities in, or omissions, from the drawings and specifications, or should he be in doubt as to their meaning, the bidder shall at once notify the Design Professional for an interpretation in the form of an addendum. Addendum will be forwarded to all bidders and each bidder shall acknowledge the receipt of each addendum on his proposal in the spaces provided. Bidders should address all inquires in written form for this project to:

CRG Architects/Palatka, Inc.
Robert Goodwin, AIA, Architect
216A St. Johns Avenue
Palatka, Florida 32177
Tel: 386/325-0213
Fax: 386/328-1401
Email: crgarchitects@comcast.net

K. Standard Basis for Bidding:

1. Equality: Where materials, etc., are referred to in the specifications as "equivalent to" or words of similar import, the Design Professional shall decide as to equality. In addition to data required under paragraph "Shop Drawings" and "Manufacturer's Description data", the contractor shall furnish other detailed data as required by the Design Professional for comparison if the product is mentioned by name. All data shall be submitted at least seven (7) days prior to the scheduled bid opening date. No extra will be allowed because of such substitution, if permitted, either for the article substituted or for revisions in other work affected by the substitution.

2. Substitutions: Where a particular system, product or material is specified by one or more trade names without the "equivalent" qualification, it shall be considered as a standard basis for bidding, and is most satisfactory for its particular purpose in the work. Substitutions for the named systems, products or materials and substitutions for any other product or material, which the bidder considered pertinent, will be considered under the following conditions only:

   a. To insure a uniform basis for bidding, the bidder shall base his proposal on the particular system, product or material named in the specifications.

   b. The bidder shall attach to his form of proposal at the time of submission, a separate sheet upon which he shall list the particular system, product or material that he wishes to substitute and directly opposite each such item, the amount that he will add to or deduct from his base bid, if such substitution is approved by the College and the Design Professional previous to the signing of the contract.

c. If no addition or deduction to the base estimate is allowed by the bidder for such substitutions, it shall be so stated opposite the item involved on the sheet attached. Substitutions so submitted shall include any and all adjustments of that or any other work affected by the substitution. Such substitutions shall be permitted and adopted only upon the written approval of the Design Professional.

d. Any proposal submitted that does not conform to the above requirements shall be considered as informal and unfair to other bidder's submitted proposals, and will not be accepted.

3. Adjustments Because of Substitutions: In general, the drawings have been prepared, based upon sizes, loads and requirements of specific items of equipment, products or materials. In the event the contractor elected to use other than the item or items for which designs have been prepared and included in the drawings, and, if because of such substitutions or changes from the conditions shown, the Design Professional is required to revise the drawings or is caused added expense therefore, the College shall be equitably reimbursed by the contractor for such costs.

a. No changes in the amount of bid appearing on the outside of the bid envelope will be considered. Only the amount shown inside the envelope will be considered. All changes, corrections and erasures must be initially by the person signing the bid.

4. Subcontractors and Shop Fabricators:

a. Bidders shall furnish with their bids and prior to the opening of bids, the names and the class of work to be performed by fabricators when the amount to be paid each subcontractor exceeds 5 percent of the total price.

b. The successful bidder shall employ the subcontractors listed in the bidder's proposal along with the class of work to be performed by each. This list shall not be modified in any way whatsoever without the written consent of the College by Change Order to ensure those subcontractors shall be utilized for the specified class of work.

c. Modifications to the listed subcontractors by Change Order may be granted by the College only in those instances where the bidder presents written evidence that use of the listed subcontractor would not be in the best interest of the College.

L. Equivalents:

1. In these specifications where one certain kind, type or brand of material manufacturer is named, it shall be regarded as the required minimum standard of quality. Substitutions lowering the performance, quality, method of assembly of installation, or in general, not in keeping with the details and specifications will not be permitted. It is understood that when a bid is submitted, the bidder is aware of the requirements, and that the materials within his bid are equal to or better on such items and that prior approval of substitutions has been obtained.

2. No time extensions will be permitted, to revise or redesign a product found not to comply, and that evidence of noncompliance shall automatically classify the bid as having been informal and rejected.

3. Since time is of the essence, the College cannot be expected to delay the award of bid, and their decisions shall be in strict accordance to the details and specifications, these items should be brought to the attention of the Design Professional of the project and of the College prior to submitting a bid proposal.

M. Disqualification of Bidders:

1. Only one proposal from an individual, firm, partnership, or corporation, under the same or different names will be considered.

2. Should there be any reasonable grounds for the College Board, believing that a collusion or combination exists between bidders, all proposals may be rejected and all such bidders or participants in such combination or collusion will not be considered in the future proposal for the same work.

3. No proposal or bid will be considered unless accompanied by a proposal guarantee or good faith deposit in the amount in the form specified in the Invitation to Bid and/or Advertisements for Bid.
4. Proposals that are incomplete or not signed by the bidder may be rejected.

5. Proposals that are submitted without the sub-bidders listing completed as required and indicated in Sections 00220 Supplementary Instructions (including Appendix A) and Section 00420 Bid Form Attachment may be rejected.

N. Return of Proposal Guarantees:

All proposal guarantees and good faith deposits will be returned immediately after the tabulation and analysis of the bids, except for the three (3) lowest bidders; these will be returned within fifteen (15) days following award of the contract.

O. Contract Award:

The College intends to award a contract to a single bidder submitting the lowest total base bid and for any bio alternate proposals contingent upon availability of funding proposals in compliance with the requirements of the Contract Documents.

P. Execution of Contract:

1. Within the (10) days after Notice of Award, the successful bidder shall enter into a formal contract. The contractor will provide a guarantee period of one (1) year against faulty work and be on the form as provided by the College.

2. Failure to execute the contract as provided in these documents within ten (10) days from the date of the notification of award shall be just cause and the College may annul and void the award and declare forfeiture of the proposal guarantee or good faith deposit in liquidation of all damages sustained.

    a. Award may then be made to the next lowest responsible bidder, or the work may be re-advertised.

3. No award will be binding upon the College until the construction contract has been executed.

4. The construction contract shall be signed in triplicate by the College and the Contractor.

Q. Bid Protests:

Bid protests pursuant to Florida Statutes §120.57 shall be served on Melissa C. Miller, Executive Vice President, SJRCC/Palatka, and Beverly Barker, Director of Purchasing and Contract Administration, 5001 St. Johns Avenue, Palatka, Florida 32177 with a copy to SJRCC Board Counsel Joe C. Miller II, 97 Orange Street, St. Augustine, Florida 32084, all via certified mail. Bid protests may be preliminarily filed, if followed by a certified mail original, via facsimile transmittal to Melissa C. Miller at 386/312-4229, Beverly Barker at 386/312-4167 and Mr. Joe Miller at 904/824-3857. Bid protests must be accompanied by a cost deposit of five thousand dollars ($5,000.00) or one percent of the total contract price, whichever is greater.

In the event the protesting party is not the prevailing party, as a result of final agency action taken by pursuant to §120.57, said cost deposit shall be retained by the College to defray its costs, expenses and fees, including reasonable attorney's fees with respect to their participation in the bid protest process. Furthermore, the unsuccessful protester shall be responsible to the College for all other and additional reasonable fees, expenses and costs, in the event the deposit which the College retains pursuant to this paragraph is insufficient to reimburse the College for all costs and fees incurred.

R. A **Mandatory Pre-Bid Conference** will be held on **November 1, 2011 at 2:00 p.m.** in Suite E, Thrasher-Horne Center at St. Johns River State College, Orange Park Campus, 283 College Drive, Orange Park, Florida. All qualified bidders or their representatives **must** attend in order to be eligible to bid.

END OF SECTION

SECTION 00130

MANDATORY PRE-BID CONFERENCE

PART 1 - GENERAL

1.01 SUMMARY

A. Prime Bidders (Pre-Qualified General Contractors) and Subcontractors from whom sub-bids are being solicited must attend the **MANDATORY PRE-BID CONFERENCE** described in the Invitation to Bid (Section 00020, this manual)

B. Attendance is mandatory for Pre-Qualified Prime Bidders.

C. Agenda Outline: Prepared by Architect

1. Attendance roster to be signed by all attendees.
2. Introduction of Owner Architect/Engineer Project Team and Attendees.
3. Project Summary and Scope of Work
4. Availability of Documents
   a. Plan Rooms
   b. General Contractors
   c. Sub-Trade Plan Availability
   d. Set Purchases (full)
5. Instructions to Bidders and Review of Bid Process (see Section 00101, this manual)
6. Contractual Agreement (Section 00520)
7. Proposal Submission Requirements & List (s) of Subcontractors (Sections 00220 and 00420)
8. Products and Substitutions (Section 01600)
9. Addenda Schedule
10. Contractor Question Period (answers will be included in an addendum)
11. Closing Statements & Site Visit

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 AGENDA:

A. Copies of this agenda will be distributed to all parties in attendance.

END OF SECTION

SECTION 00210

PROJECT SCHEDULE

The construction time for this project is strictly limited to the project time schedule outlined below:

- Bid Documents/Plans Available to Pre-Qualified General Contractors
    - Date: On or about October 21, 2011 (Available from CRG Architects/Palatka, Inc.)
- **Mandatory Pre-Bid Conference**
    - Date: November 1, 2011
    - Time: 2:00 P.M.
    - Location: Suite E, Thrasher-Horne Center at St. Johns River State College, Orange Park Campus, 283 College Drive, Orange Park, Florida
- Deadline for Bid Submission
    - Date: December 2, 2011
    - Time: By 2:00 p.m.
    - Location: Sealed bids, bearing on the outside of the envelope the name of the contractor and 'BID-SJR-2011-07, must be received in the St. Johns River State College, **Business Office, Attention: Beverly Barker**, 5001 St. Johns Avenue, Palatka, FL 32177
- Public Meeting to Verbally Announce Bids Received (Bid Opening)
    - Date: December 2, 2011
    - Time: 2:30 p.m.
    - Location: St. Johns River State College, **Board Room (A-154),** 5001 St. Johns Avenue, Palatka, FL 32177
- Electronic Posting of Recommendation for Bid Award
    - Date: On or about December 5, 2011 (viewable at www.sjrstate.edu/201107)
- Award of Bid by Board of Trustees
    - Date: December 14, 2011
    - Time: 4:00 p.m.
    - Location: Board of Trustees Meeting, St. Johns River State College, Board Room A-154, 5001 St. Johns Avenue, Palatka, FL 32177

- Electronic Posting of Bid Award
    - Date: On or about December 15, 2011 at www.sjrstate.edu/201107
- Notice to Proceed Issued:
    - December 26, 2011
- Pre-Construction Conference
    - Date: TBA
    - Time: TBA
    - Location: St. Johns River State College, Valhalla Hall, 5001 St. Johns Avenue, Palatka, Florida.
- Substantial Completion: July 31, 2012 (219 calendar days)
- Final Completion: August 10, 2012 (11 calendar days)

END OF SECTION

SECTION 00220

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

The following supplements modify, change, delete from or add to the "Instructions to Bidders", AIA Document A701, Fourth Edition, 1997.

Where any Article of the Instructions to Bidders is modified or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these Supplementary Instructions to Bidders, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

Add the following new Articles:

Article 9, Liquidated Damages

9.1 The Bidder agrees that liquidated damages in the amount of One Thousand Dollars ($1,000) per calendar day for each day the work remains incomplete, shall be assessed against the Bidder if the work is not completed within the specified time limit. It shall be understood that liquidated damages are not a penalty, but are intended to provide a means of recovery of actual damages suffered by the Owner as a result of delayed completion.

Article 10, Contract Time

10.1 Contract time to be Two Hundred Nineteen (219) calendar days

The following is Supplemental Bid Information

Bidding Questions

Questions concerning the bidding process and bid specifications, other than the technical specifications, should be directed to Beverly Barker, Director of Purchasing and Contract Administration, via email at BeverlyBarker@sjrstate.edu or by calling 386-312-4110.

Questions concerning the technical specifications of this bid shall be directed in writing, referencing the drawings and specifications to Robert C. Goodwin, AIA, Architect, CRG Architects/Palatka, Inc., crgarchitects@comcast.net, tel: 386-325-0213, fax: 386-328-1401.

Definitions

The College, SJR State, or St. Johns River State College, refers to the District Board of Trustees of St. Johns River State College, Palatka, Florida. The College is a political subdivision of the State of Florida.

Firm, vendor, contractor or bidder in this document refers to respondents to this invitation to bid.

Taxes

The College does not pay federal, excise, or state sales taxes. The applicable tax-exemption numbers are:

Florida Sales Tax: 85-8013170533C-4
Federal Identification Number: 59-1033399

Mandatory Pre-Bid Conference

Attendance at the Mandatory Pre-Bid Conference is a requirement in order to be eligible to bid.

Bidding Costs

St. Johns River State College is not responsible for any cost incurred by bidders in their efforts in submitting this bid.

Bid Bond

Bid guarantee in the form of a Bid Bond executed by the bidders and a qualified surety, or a certified or cashier's check on national or state bank in the amount of five percent (5%) of the proposal, including alternates, made payable to St. Johns River State College, must accompany the proposal.

Open Competition

The College encourages free and open competition among Pre-Qualified Firms. Whenever possible, specifications, bid invitations, and conditions are designed to accomplish this objective, consistent with the necessity to satisfy the College's needs and the accomplishment of a sound economical operation. The Firm's signature on the Bid Checklist/Response Form guarantees that the Firm, its agents, officers, or employees have not been bribed or attempted to bribe or influence in any way an officer, employee or Agent of the College.

Minority & Women Owned Business Enterprises (M/WBE) Participation

M/WBE participation is encouraged.

Insurance Coverage

Contractor shall obtain, maintain, and pay for insurance in the categories listed in the insurance schedule. The insurance coverage is each category shall meet or exceed the minimum limits set forth in the insurance schedule. The College, the Board of Trustees of St. Johns River State College and the State of Florida shall be included as additional named insured on each policy. The insurance shall cover the Firms entire operations under Agreement with the College and shall be effective throughout the effective period of this Agreement. It is not the intent of this schedule to limit the types of insurance otherwise required by this Agreement or that the Firm may desire to obtain.

Minimum Insurance Requirement Schedule

Refer to 00801 Supplementary Conditions For All Insurance Requirements.

Bid Award Process

The bid award shall be made to the lowest and best proposal, Base and Alternates within budget, which meets or exceeds the conditions of the bid specifications and the College reserves the right to award by individual item, groups of items, "All or None" or a combination thereof contingent upon budget availability. The College is not necessarily bound to accept the lowest bid if that bid is contrary to the best interests of the College. The District Board of St. Johns River State College reserves the right to waive any minor deviations in otherwise valid bid proposal, to waive any informalities, to reject any or all bid proposals, and to accept the bid which will be in the best interest of the College. In addition, the College shall have the right to reject any bid not accompanied by data required by the bid specifications, or a proposal in any way incomplete or irregular. Conditional bids will not be accepted. Bidders are cautioned to make no assumption until St. Johns River State College has entered into a contract and issued related purchase order(s).

Bid Rejection

The College shall have the right to reject any or all bids and in particular to reject a bid no accompanied by data required by the bid specifications or a proposal in any way incomplete or irregular. Conditional bids will not be accepted.

Bid Specification Interpretation

Interpretation of the wording of this document shall be the responsibility of the College and that interpretation shall be final.

Bid Response Materials

The materials submitted in response to this invitation to bid becomes the property of the College upon delivery to the Office of the Director of Purchasing and Contract Administration and may be appended to any formal document which would further define or expand the contractual relationship between the College and the successful bidder.

Errors and Omissions

The successful bidder is expected to comply with the true intent of these bid specifications taken as a whole and shall not avail itself of any errors or omissions to the detriment of the services. Should successful bidder suspect any error, omission or discrepancy in the specifications or instructions, the successful bidder shall immediately notify the College, in writing, and the College shall issue written instructions to be followed. The successful bidder is responsible for the contents of its proposal and for satisfying the requirements set forth in the bid specifications.

Bidder Responsibility

It is understood, and the bidder hereby agrees, that it shall be solely responsible for all services that it proposes, notwithstanding the detail present in the bid specifications.

Severability

If any provisions of the agreement resulting from this bid are contrary to, prohibited by, or deemed invalid by applicable laws or regulations of any jurisdiction in which it is sought to be enforced, then said provisions shall be deemed inapplicable and omitted and shall not invalidate the remaining provisions of the agreement.

In the event any provision of this agreement shall be held invalid or unenforceable by a court of competent jurisdiction, or by an administrative hearing officer in accordance with Chapter 120, Florida Statutes, such holding shall not invalidate or render unenforceable any other provision hereof.

Venue

The contract, when entered into and any disputes hereunder, shall be construed in accordance with the laws of the State of Florida and enforced in the courts of the State of Florida. College and Firm hereby agree that venue shall be in Putnam County, Florida.

Americans with Disabilities Act of 1990

If special accommodations are required in order to attend the Public Meeting to announce bids received, contact the Director of Purchasing and Contract Administration at 386-312-4110 or email BeverlyBarker@sjrstate.edu a minimum of three business days prior to the meeting.

Protests of Awards or Specifications

Failure to file a protest within the time prescribed in § 120.57(3) Florida Statutes, shall constitute a waiver of proceedings under Chapter 120, Florida Statutes.

Independent Firm

Nothing herein is intended or shall be construed in any way creating or establishing the relation of co-partners between the parties or in any way making the Firm the agent or representative of the College for any purposes in any manner whatsoever. Firm is, and shall remain, an independent Firm with respect to all services performed.

Laws, Ordinances, Rules, Regulations, Permits, and Licenses

The Firm shall observe and obey all laws, ordinances, rules, regulation, and policies of the District Board of Trustees of St. Johns River State College and the federal and state governments which may be applicable to the Firm's operation at St. Johns River State College, and shall, at the sole cost to the Firm, obtain and maintain all permits and licenses necessary to comply with such requirements and standards.

INSTRUCTIONS FOR SUBMISSION OF BIDS

Instructions to Bidders

Sealed bids will be accepted in the office of the **Director of Purchasing and Contract Administration, St. Johns River State College, Business Office, 5001 St. Johns Avenue, Palatka, FL 32177** until **2:00 p.m. EST** on **December 2, 2011.** The bid submission must be sealed and clearly marked **'BID SJR-2011-07'** on the outside of the package containing the bid response. Bids received after that time and date will be marked late and will not be considered. It is the sole responsibility of the applicant to ensure that bids are delivered to the Office of the Director of Purchasing and Contract Administration, St. Johns River State College, 5001 St. Johns Avenue, Palatka, Florida prior to the deadline. Facsimile (fax) and/or email bids are not acceptable and shall not be considered.

Submit one original (marked as Original) and one copy (marked as Copy) of your bid response. The bid response must include a signed Bid Checklist/Response Form and each document indicated on this form. All documents should be bound or stapled to the Bid Checklist/Response Form. The documents should be included in the response in the following order:

- Bid Checklist/Response Form (Use Appendix A)
  NOTE: In order to be considered, the response to this bid must be submitted on this form and the form must be signed.
- Bid Bond
- Copy of License to do business in the State of Florida
- List of Subcontractors (Name, Address, and License Number REQUIRED)

Bid Response Authorization

The bid response shall be signed by a person legally authorized to bind the Firm.

Firm Warranty of Ability to Perform

Firm shall warrant by authorized signature on the bid response that there is no action suit, proceeding, inquiry, or investigation, at law or equity, before or by a court, governmental agency, public board or body, pending or, to the best of the Firm's knowledge, threatened, which would in any way prohibit, restrain, or enjoin the execution or delivery of the Firms obligations, diminish the Firm's obligations or diminish the Firm's financial ability to perform the terms of the proposed contract.

Contract

The successful bidder will enter into a contract with the College based on bid documents and the result of the bid.

Assignment

Neither this agreement nor any duties or obligations under this agreement or resulting contract(s) shall be assigned by Firm without prior written consent of the College.

Indemnification

The firm shall indemnify and hold harmless the College, and any agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Firm or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense, is caused in part by a party indemnified hereunder. Such obligations shall not be considered to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist.

Payment

When the Contractor receives payment from the Owner for labor, services, or materials furnished by subcontractors and suppliers hired by the Contractor for the project, the Contractor shall remit payment due to those subcontractors and suppliers, less the value of any items contested in accordance with the Contract, within 10 days after the Contractor's receipt of payment from the Owner. When the payment due the subcontractor is for final payment, including retainage, the subcontractor must include with the invoice for final payment a conditional release of lien and all appropriate warranties and closeout documentation. When the subcontractor receives payment from the Contractor for labor, services, or materials furnished by subcontractors and suppliers hired by the subcontractor, the subcontractor shall remit payment due to those subcontractors, less the value of any item contested in accordance with the contract, within ten (10) days after the subcontractor's receipt of payment.

END OF SECTION

APPENDIX A
BID SJR-2011-07
BID CHECKLIST / BID FORM

Bid Checklist:

Place an "x" on the lines below of the documents attached to this form.

_____ Copy of license to do business in the State of Florida

_____ Section 00307 – Public Entity Crime Statement

_____ Section 00308 – Drug Free Workplace Form

_____ Section 00309 – Trench Safety Act Certification

_____ Section 00420 – Bid Form Attachment, List of Subcontractors

_____ Section 00435 – Bid Bond Form

Bid Response Form:

The undersigned Bidder hereby declare that the only person or persons interested in this proposal as Principal is named herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without any connection with any person, company, or party submitting a proposal; and that it is in all respects fair and in good faith, without collusion or fraud.

The Bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the places where the work is to be done; that he has satisfied himself relative to the work to be performed and agrees to and by them.

_____

NAME OF BIDDER

The bidder proposes and agrees to provide all necessary materials, equipment, machinery, tools, apparatus, and means of transportation, labor and services necessary to complete the construction of the Health Sciences Building at St. Johns River State College, St. Augustine Campus.

Base Bid Proposal: $ _____

Base Bid Proposal Spelled Out:

_____

Bid Alternate No.1: ADD $ _____

Bid Alternate No.2: ADD $ _____

Bid Alternate No.3: ADD $ _____

Bid Alternate No. 4 ADD: $ _____

Bid Alternate No. 5 ADD: $ _____

Bid Alternate No.6: ADD $ _____

Unit Price A: $_____ per 100 square feet

Unit Price B: $_____ per 100 lineal feet

Unit Price C: $_____ per 100 lineal feet

Unit Price D: $_____ per 100 lineal feet

Unit Price E: $_____ per 25 lineal feet

The Bidder proposes and agrees hereby to commence the Work with an adequate force and equipment within seven (7) consecutive days after being notified by the Owner to do so, and shall carry on at a rate to secure Substantial completion as indicated in the Supplementary Instructions to Bidders.

The Bidder agrees that Liquidated Damages in the amount as indicated in the Supplementary Instructions to Bidders for each day the work remains incomplete, shall be assessed against him if the work is not completed within the above specified time limit.

Attached hereto is a Bid Bond in the sum of

_____ Dollars ($ _____)

made payable to the Owner.

The following Addenda were received:

Addendum ____, Dated _____ Addendum ____, Dated _____

Addendum ____, Dated _____ Addendum ____, Dated _____

Addendum ____, Dated _____ Addendum ____, Dated _____

Date: _____

Authorizing Signature: _____

All companies certify by their signature that they have read and understand the conditions and specifications of the bid and have included all required documents, and that they have the authority, capacity, and capability to perform according to the conditions and specifications of BID SJR-2011-07.

Company Name: _____

Address: _____

City, State, Zip: _____

Telephone Number: _____

Authorized Signature: _____

Printed Name: _____

Title: _____

END OF SECTION

SECTION 00307

PUBLIC ENTITY CRIME FORM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. St. Johns River State College will require for this project, in accordance with F.S. 287.017, a Public Entity Crime Statement form be attached with the bid. This form must be completed and submitted with the Bids and Contract Documents from all subs, material suppliers, and/or consultants for the project. See sample form enclosed.

PART 2 – PRODUCTS *(Not Used)*

PART 3 – EXECUTION *(Not Used)*

END OF SECTION

PUBLIC ENTITY CRIME STATEMENT

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases or real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for Category Two for a period of 36 months from the date of being placed on the convicted vendor list.

I, _____, being an authorized representative of the firm of

_____, located at _____

City: _____, State: _____ Zip: _____

have read and understand the contents of the above. As the person authorized to sign the statement, I certify that this form is not on the convicted vendor list and complies fully with the above requirements.

Signature: _____ Date: _____

Telephone: _____

Fax: _____

Federal ID# _____

SECTION 00308

DRUG-FREE WORKPLACE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. St. Johns River State College Drug Free Workplace Form is attached. This form must be copied, completed, and submitted with the Contract Documents.

PART 2 – PRODUCTS *Not used*

PART 3 – EXECUTION *Not used*

END OF SECTION

DRUG FREE WORKPLACE PROGRAM FORM

In order to have a drug-free workplace program, a business shall:

1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.

2) Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in Subsection (1).

4) In the statement specified in Subsection (1), notify the employees that, as a condition of working in the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occurring in the workplace no later than five (5) days after conviction.

5) Impose a sanction on, or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.

6) Make good faith effort to continue to maintain a drug-free workplace through implementation of this section.

AS THE PERSON AUTHORIZED TO SIGN THIS STATEMENT, I CERTIFY THAT THIS FIRM,

_____

(Name of Company)

COMPLIES FULLY WITH THE ABOVE REQUIREMENTS.

Authorized Signature Date

_____ _____

TRENCH SAFETY CERTIFICATION

Provide price for trench safety for trench excavations in excess of five (5) feet deep in accordance with the Trench Safety Act, Chapters 90-96, Laws of Florida and OSHA Standard 29 C.F.R. s.1926.650, Subpart P. The Bidder by execution of this Bid Proposal certifies that he will comply fully with the above said Trench Safety Act and OSHA Safety and Health Standards.

The Contractor herein verifies that he is aware of the Trench Safety Act and has in his bid all costs related to the requirement of this Act.

_____

Certified by Contractor

SECTION 00420 BID FORM ATTACHMENT – LIST OF SUBCONTRACTORS

DIVISION OF WORK	PROPOSED SUBCONTRACTOR	PRINCIPAL/OFFICER	CORP. ADDRESS	LICENSE NO.
DEMOLITION				
CONCRETE				
STRUCTURAL STEEL				
DRYWALL				
ACOUSTICAL CEILING				
CERAMIC TILE				
VCT FLOORING				
PAINTING				
HVAC				
ELECTRICAL				
PLUMBING				
ROOFING				
POLISHED CONCRETE FLOORING				

SIGNED: _____

(BIDDER)

END OF SECTION

SECTION 00435

BID BOND FORM

BID BOND FORM

AIA Document A310, Bid Bond, 2010 version, is the form to be used.

AIA Document A310 may be purchased from the Florida Association of the American Institute of Architects, (AIA Florida), 104 East Jefferson Street, Tallahassee, Florida, tel: 904-222-7590, fax: 904-224-8048, or may be examined at the Architect's office.

END OF SECTION

DRAFT

AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«SAMPLE»
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

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

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

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

« »

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

« »

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

« »

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported

by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of « » percent (« » %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of « » percent (« » %);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

« »

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.10 When the Contractor receives payment from the Owner for labor, services or materials furnished by subcontractors and suppliers hired by the Contractor for the project, the Contractor shall remit payment due to those subcontractors and suppliers, less the value of any item contested in accordance with the contract, within ten (10) days after the Contractor's receipt of payment by the Owner. When the payment due the subcontractor is for final payment, including retainage, the subcontractor must include with the invoice for final payment a conditional release of lien and all appropriate warranties and closeout documentation. When the subcontractor receives payment from the Contractor for labor, services, or materials furnished by subcontractors and suppliers hired by the subcontractor, the subcontractor shall remit payment due to those subcontractors, less the value of any item contested in accordance with the contract, within ten (10) days after the subcontractor's receipt of payment.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

§ 8.3 The Owner's representative:
(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 The Contractor's representative:
(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

« »

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

« »

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.
(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	Limit of liability or bond amount ($0.00)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

SECTION 00600

BONDS AND CERTIFICATES

PART 1 – GENERAL

1.1 PERFORMANCE AND PAYMENT BOND

A. AIA Document A312 Performance and Payment Bond, 2010 Edition is the form of to be used for this Work.

B. AIA Document A312 may be purchased from the Florida Association of the American Institute of Architects, (AIA Florida), 104 East Jefferson Street, Tallahassee, Florida, tel: 904-222-7590, fax: 904-224-8048, or may be examined at the Architect's office.

1.2 PERFORMANCE BOND AND LABOR & MATERIAL PAYMENT BOND

A. AIA Document A312 Performance and Payment Bond, 2010 Edition is the form of to be used for this Work.

B. AIA Document A312 may be purchased from the Florida Association of the American Institute of Architects, (AIA Florida), 104 East Jefferson Street, Tallahassee, Florida, tel: 904-222-7590, fax: 904-224-8048, or may be examined at the Architect's office.

1.3 BONDS SPECIFIED ELSEWHERE

A. See Divisions 1 – 16 for other bonds, warranties, etc., that may be required.

1.4 CERTIFICATE OF INSURANCE

A. Contractor shall provide all relevant certificates of insurance.

END OF SECTION

SECTION 00700

GENERAL CONDITIONS OF THE CONTRACT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. AIA Document A201, General Conditions, 2007 Edition, Articles 1-15 inclusive, are hereby made a full part of the contract documents and will be the General Conditions for this work.

B. AIA Document A201 may be purchased from the Florida Association of the American Institute of Architects, (AIA Florida), 104 East Jefferson Street, Tallahassee, Florida, tel: 904-222-7590, fax: 904-224-8048, or may be examined at the Architect's office.

PART 2 – PRODUCTS (*Not used)*

PART 3 – EXECUTION (*Not used)*

END OF SECTION

SECTION 00801

SUPPLEMENTARY CONDITIONS OF THE CONTRACT

INTRODUCTORY PARAGRAPH

The following supplements, modify, change, delete from or add too the General Conditions of the Contract for Construction, AIA Document A201, 2007. Where a portion of the General Conditions is modified or deleted by these supplements, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1 GENERAL PROVISIONS

1.1.3 THE WORK

Add the following sentence to the end of Paragraph 1.1.3

The term “furnish” includes purchase and delivery to Project Site. The term “install” includes receiving, unloading and storing at Project site, installing in place, and placing in operation or finishing complete for intended use. The term “provide” includes furnishing and installing.

1.1.9 MISCELLANEOUS DEFINITIONS

1.1.9.1 The term “provide” as used in the Project Manual means to furnish and install, complete and ready for intended use.

1.1.9.2 The term “product” as used in the Project Manual includes materials, fabrications, systems, and equipment.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following subparagraphs to Paragraph 1.2

1.2.4 Should the drawings and specifications conflict on any point, the work is to be done according to the Specifications insofar as the quality of materials and workmanship is concerned; but the Drawings shall govern insofar as the form or extent of the work is concerned. Should details and schedules shown on drawings conflict on any point, the schedules prevail. Large-scale details prevail over small-scale plans and elevations, and figure dimensions over scaled dimensions. AIA General Conditions, Addenda, and Change Orders supersede the affected portions of the Documents.

1.2.5 The Drawings are intended to show the general arrangements, design and extent of the Work, and are partly diagrammatic; they are not intended to be called for rough-in measurements, or to serve as Shop Drawings. In general, the better quality or greater quantity of Work or materials shall be furnished unless otherwise indicated in Writing by the Architect.

1.2.6 Where a typical or representative detail is shown on the Drawings, this detail shall constitute the standard in workmanship and materials throughout corresponding parts of the Work; adaptation, however, shall be subject to the approval of the Architect.

1.6 TRANSMISSION OF DATA IN DIGITAL FORM

Add the following subparagraph 1.6.1 to Paragraph 1.6

1.6.1 Contractor’s Use of Instruments of Service in Electronic Form

.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect.

ARTICLE 2 OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Paragraph 2.2.2: At the end of this paragraph, add the following new text:

> As it relates to sanitary sewer and water utility services, the Owner shall pay any applicable capital facilities fees or front footage fees, tap fees, water meters, or other required equipment items related to services provided by the utility entity.

Paragraph 2.2.5, delete the text in this paragraph and replace with the following new text:

> 2.2.5 Upon award of the Contract, the Architect will furnish to the Contractor without charge, five (5) set of Contract Drawings, Specifications and Addenda. The Contractor may obtain additional sets of the above from the Architect, at the cost of printing and handling.

ARTICLE 3 CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Add the following Clause after Subparagraph 3.2.1

3.2.1.1 Contractor shall ascertain the location of all existing utilities prior to beginning new and alteration work. Verify locations of utility lines shown on drawings; locate and mark each utility prior to start of construction. Any damage caused to any utility as a result of Work on this Project shall be promptly repaired or replaced at the sole expense of the Contractor and no additional money will be paid by the Owner.

Add the following Subparagraph 3.2.5 to Paragraph 3.2

3.2.5 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, or other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

Add the following Subparagraph 3.2.6

3.2.6 Claims for additional compensation or extensions of time because of the failure of the Contractor to field verify proposed and existing Work will not be allowed.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following after Subparagraph 3.3.1

.1 The Contractor shall review, verify, and be in agreement with any specified construction or installation procedure and instruction prior to performing the Work, including manufacturers recommended and referenced standards, and shall report to the Architect at once if the specified procedure and instruction (1) does not appear to follow reasonable construction practice, (2) may invalidate any specific warranty or the general Contractor's warranty, or (3) may be objectionable to the Contractor for some reason.

3.3.1.2 In conjunction with reporting an objection, the Contractor shall propose, in writing, alternative procedures to which the Contractor will agree and warrant.

3.4 LABOR AND MATERIALS

Delete Subparagraph 3.4.2 and add the following:

3.4.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.

.2 represents that the Contractor will provide the same warranty for the substitutions that the Contractor would for that specified.

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's re-design costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

Add the following Subparagraph 3.4.4 to Paragraph 3.4

3.4.4. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

Add the following to Subparagraph 3.4.3

Should the Architect or Owner find any person(s) employed on the project to be incompetent, unfit, or otherwise objectionable for his duties, the Contractor shall immediately cause the employee to be dismissed and said employee shall not be re-employed on this project without the written consent of the Architect and the Owner.

After paragraph 3.4.4, add the following new paragraph 3.4.5:

3.4.5 The Owner will require of the Contractor that, to the fullest extent possible, preference in the employment of all skilled and unskilled labor, other than the Contractor's key personnel, be given to residents of Putnam, St. Johns and Clay counties when such labor is available and qualified to do the type of work required.

3.5 WARRANTY

After paragraph 3.5, add the following new Subparagraph 3.5.1:

3.5.1 Specific and special warranties specified are in addition to and not in lieu of the Contractor's general warranty.

3.6 TAXES

Add the following to Paragraph 3.6

3.6.1 Contractor shall pay unemployment and Social Security taxes and other taxes imposed by Local, City, State, or Federal government and certify to Owner that this has been done before final payment is made to Contractor.

3.6.2 SJR State reserves the right to implement a sales tax savings program by selecting certain items for Direct Purchase. See Article 16.6 of these Supplementary Conditions.

3.7 PERMITS, FEES AND NOTICES

Delete Subparagraph 3.7.1 and substitute the following:

3.7.1 The Owner shall secure and pay for the building permit and the Contractor shall secure and pay for all other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

Add the following Clause 3.7.1.1 to Subparagraph 3.7.1

3.7.1.1 Contractor shall provide copies of Change Orders to the Building Official and DOE.

3.9 SUPERINTENDENT

Add the following Subparagraph 3.9.4 to Paragraph 3.9

3.9.4 The Contractor shall employ a superintendent or an assistant to the superintendent who will perform as coordinator for the mechanical and electrical work. The coordinator shall be knowledgeable in mechanical and electrical systems and capable of reading, interpreting and coordinating Drawings, Specifications, and shop drawings pertaining to such systems. The coordinator shall assist the Subcontractors in arranging space conditions to eliminate interference between the mechanical and electrical systems and other work, and shall

supervise the preparation of coordination drawings documenting the spatial arrangements for such systems within restricted spaces. The coordinator shall assist in planning and expediting the proper sequence of delivery of mechanical and electrical equipment to the site.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Add the following Subparagraph 3.12.11 to Paragraph 3.12

3.2.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submittal and two (2) resubmittals. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for evaluation of such additional resubmittals.

3.13 USE OF SITE

Add the following Subparagraph 3.13.2 and 3.13.3 to Paragraph 3.13

3.13.2 The Contractor shall confine his equipment, storage of materials, and operations of his workmen to limits directed by the Architect. Materials shall not be brought onto the site until reasonably required for the progress of the Work. Storage space will be confined to a designated area of the site. When the site is not in a condition to receive a material shipment, the Contractor shall have materials properly stored elsewhere at no additional cost to the Owner. No payment for materials shall be made unless material is stored on site.

3.13.3 Material shall be arranged and maintained in an orderly manner with use of walks, drives, roads, and entrances unencumbered. Store, place, and handle material and equipment delivered to project site so as to preclude inclusion of foreign substances or causing discoloration. Pile neatly and completely and barricade to protect public from injury. Protect material as required to prevent damage from ground or weather. Should it be necessary to move material at any time, or move sheds or storage platforms, Contractor shall move them as and when required at no additional cost to the Owner. The Owner assumes to responsibility for stored materials in building or on site. The Contractor shall assume full responsibility for damage due to storing of materials. Repairing of areas used for the placing of sheds, offices, and storage of materials shall be done by Contractor.

3.14 CUTTING AND PATCHING

After paragraph add the following new paragraph 3.14.3:

3.14.3 Existing structures and facilities, including but not limited to buildings, utilities, topography, streets, cubs, sidewalks, landscape materials and other improvements that are damaged or removed due to Contractor's work, shall be patched, repaired, or replaced by the Contractor to the satisfaction of the Architect and authorities having jurisdiction. In the event that local authorities having jurisdiction require that such repairing and patching be done with their own labor and materials, the Contractor shall abide by such regulations and pay for such work.

ARTICLE 4 ARCHITECT

4.2 ADMINISTRATION OF THE CONTRACT

Paragraph 4.2.3, at the end of this paragraph, add the following new text:

> If on-site inspections and observations disclose defects and deficiencies, or work not being carried out **in accordance with the Contract Documents, the Architect shall request the Contractor to correct such deficiencies.** If the Contractor fails to take corrective action within a reasonable time, the Architect will notify the Owner in writing with copy of such notice to the Contractor, calling the Owner's attention to the Contractor's failures to carry out the provisions of the Contract.

at the end of Paragraph 4.2.13, add the following new text to the end of the last sentence:

> And, if and when approved by the Owner.

Add the following Clause after Subparagraph 4.2.4:

4.2.4.1 Any direct communication between the Owner and Contractor which may affect the administration or performance of the Contract shall be made or confirmed in writing, with copies to the Architect.

ARTICLE 5 SUBCONTRACTORS

5.2 THE AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

In the first sentence of Subparagraph 5.2.1, change the phrase "…as soon as practicable…" to read "…within 10 days…"

ARTICLE 6 CONSTRUCTION BY OWNER OR SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY, after paragraph 6.2.5, add the following paragraph 6.2.6:

6.2.6 Claims, disputes and other matters in question between the Contractor and a separate contractor shall be subject to the provisions of Paragraph 4.3, provided the separate contractor has reciprocal obligations. If such separate contractor sues the Owner on account of damages alleged to have been sustained, Owner shall have option of defending such proceeding or of notifying Contractor who shall defend such proceeding and shall pay all costs in connection therewith; and if any judgment against Owner arises therefrom, Contractor shall pay or satisfy it, together with Owner's reasonable costs, including attorney's fees and court costs.

Add the following Subparagraphs to Paragraph 6.2

6.2.7 Project meetings will be held at times designated by the Architect after conference with the Contractor. Contractor and designated Subcontractors must attend these meetings. If the principal of the firm does not attend meetings, the individual representing the firm must be a responsible representative of the company who can bind the company to a decision at the meeting.

6.2.8 Contractor or Contractor's representative shall, on a monthly basis, at a minimum, prepare and present an oral and written report to the Board of Trustees at one of its regularly scheduled meetings. The written report shall be provided to the Board's Secretary ten (10) days in advance of the meeting at which the oral report will be made. The Board may, at its discretion, from time to time, modify this schedule to decrease the frequency of these reports or to modify the form or content of the reports. Such report shall include, as a minimum, a progress report, problem areas, if any, conditions and requests for change orders, and other information as may be requested from time to time by the Owner.

ARTICLE 7 CHANGES IN THE WORK

7.1 GENERAL

Add the following to Paragraph 7.1.3

"The cost of all changes in the Work shall be substantiated by complete itemized statements showing quantities and unit prices for all material, labor (including all fringe benefits), equipment and other items of cost. Coast of labor (including applicable fringe benefits) and materials shall be actual costs to the Contractor. The Contractor shall submit receipts or other evidences, as the Architect may direct, showing his actual costs and his rights to the payment claims"

Add the following Paragraph 7.1.4 and Clauses to Paragraph 7.1

7.1.4 In the maximum percentage of profit and overhead which may be added to actual costs of changes in the Work shall be as follows:

.1 For Work done by his own organization, the Contractor may add ten percent (10%) of his actual costs.
.2 For Work done by Subcontractors, the respective Subcontractor may add ten percent (10%) of their costs and the Contractor may add ten percent (10%) of the above Subcontractor's total.
.3 Overhead shall include the following: Supervision, wages or time-keepers, watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost".
.4 Authorizations for changes in the Work shall be made in writing to the Architect and the Owner, and no claim for a revision of the Contract Sum shall be valid unless so authorized.

7.3 CONSTRUCTION CHANGE DIRECTIVES

Paragraph 7.3.7 Delete the first sentence and replace with the following new first sentence:

If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an allowance for overhead and profit in accordance with the Contract Specifications.

Paragraph 7.3.7, at the end of this paragraph add the following new text:

Costs shall not include any of the following:

.6 Salaries or other compensation of the Contractor's personnel at the Contractor's office unless direct additional expenses have been incurred exclusively because of the change;
.7 Expenses of the Contractor's offices, including the field office;
.8 Any part of the Contractor's capital expenses, including interest on the Contractor's capital;
.9 Costs due to the negligence of the Contractor, or any Subcontractor
.10 Overhead, general expense, and the cost of any item not specifically or reasonably inferable as included in the items described in 7.3.6.1 through 7.3.6.5.

ARTICLE 8 TIME

Add the following Subparagraphs to Paragraph 8.2

8.2.4 The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours, including night shifts and overtime operations, as may be necessary to insure prosecution of the work in accordance with the approved progress schedule. If the Contractor falls behind the progress schedule, he shall take such steps as may be necessary or as may be directed by the Architect to improve his progress by increasing the number of shifts, overtime operations, days of work, and the amount of construction plant, as may be required, at no additional cost to the Owner.

8.2.5 Failure of the Contractor to comply with the requirements under this provision shall be grounds for determination that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified and such failure constitutes a substantial violation of the conditions of the Agreement.

8.2.6 Upon such determination, the Owner may terminate the Contractor’s right to proceed with the work, or any separate part thereof, in accordance with Paragraph 14.2.

8.2.7 Failure to complete the project within the time fixed in the Agreement will result in substantial injury to the Owner, and damages arising from such failure cannot be calculated with any degree of certainty; therefore, if the project is not substantially completed within the time fixed in the Agreement, or within such further time, if any, as shall be allowed for substantial completion, the Contractor shall pay to the Owner liquidated damages for such delay for each and every calendar day elapsing between the date fixed for substantial completion and the date such substantial completion shall have been fully accomplished in accordance with the following:

SCHEDULE OF LIQUIDATED DAMAGES:

One Thousand Dollars ($1,000.00) per calendar day.

8.2.8 Provision for assessment of liquidated damages for delay shall in no manner affect the Owner’s right to terminate the Contract as provided in Article 14 of the General Conditions or elsewhere in the Contract Documents. The Owner’s exercise of the right to terminate shall not release the Contractor from his obligation to pay said liquidated damages in the amounts set out in the Agreement.

8.2.9 The Owner may deduct from the balance retained by the Owner under the provisions of Paragraph 9.4.3 any liquidated damages which may have occurred of such portion thereof as the said balance will cover.

ARTICLE 9 PAYMENTS AND COMPLETION

Add the following after Subparagraph 9.1.1.

9.1.2 In conformance with the requirements of Section 725.06, Florida Statutes, the specific considerations for the Contractor’s promises are:

9.1.2.1 One dollar ($1.00) in hand paid by the Owner, the Architect and the Architect's employees to the Contractor, receipt whereof is hereby acknowledged and adequacy of which the Contractor accepts as completely fulfilling the obligations of the Owner, the Architect and the Architect's employees under the requirements of Section 725.06, Florida Statutes, and;

9.1.1.2 The entry of the Owner and the Contractor into the construction contract because, but for the Contractor's promises as contained in the Contract Documents, the Owner would not have entered into the construction contract with the Contractor.

9.3 APPLICATION FOR PAYMENT

Add the following Clause to Subparagraph 9.3.1:

9.3.1.3 Until Substantial Completion, the Owner will pay ninety percent (90%) of the amount due the Contractor on account of progress payments.

In Subparagraph 9.3.3, change the first sentence to read:

"The Contractor warrants that title to all work and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon receipt of payment by the Contractor."

In the second sentence of Subparagraph 9.3.3., delete the words, "to the best of the Contractor's knowledge and belief"

9.4 CERTIFICATES FOR PAYMENT

Add the following to Subparagraph 9.4

9.4.3 Ten percent (10%) of each payment will be retained until the Contract, including Change Orders, is substantially complete. Payments of the amounts retained will be due after final acceptance by the St. Johns River State College District Board of Trustees and issuance of certificates as described in Paragraph 9.10.1

9.6 PROGRESS PAYMENTS

In the first line of Subparagraph 9.6.3, change the words "The Architect will, on request…" to read, "The Architect may, on request and at his discretion…"

9.8 SUBSTANTIAL COMPLETION

Add the following Clause 9.8.3.1 to Subparagraph 9.8.3

9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work, or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

9.8.5 Delete the second sentence and substitute the following:

"Upon such acceptance and consent of surety, if any, the Owner shall make payment sufficient to increase the total payments to Ninety-Five Percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for incomplete work and unsettled claims."

9.10 FINAL COMPLETION AND FINAL PAYMENT

Add the following Clauses to Subparagraph 9.10.1:

.1 The Architect will file with the St. Johns River State College Building Official a Request for Final Inspection. Prior to final payment, a Certificate of Final Inspection from the Department of Education is required in conjunction with the following actions by the Architect.

.2 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work, or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

Add the following Subparagraph to Paragraph 9.10

9.10.6 Final payment shall be made to the Contractor as provided by the Agreement between the Owner and Contractor. Application for final payment shall in the same form as application for progress payments as described in Paragraph 9.3.1 and shall be accompanied by the following additional items:

.1 Completed and notarized waivers and releases of lien in a form acceptable to the Architect and Owner (refer to attached Waiver of Lien Certificate).
.2 Certificates of Inspection and Occupancy as required by law.
.3 Such other data and substantiating information as may be required elsewhere in these Contract Documents including but not limited to all required guarantees, warranties, operating and maintenance manuals, As-Built drawings, or as may be required by the Owner or Architect and as described in DIVISION 1, SECTION 1700 PROJECT CLOSEOUT.

ARTICLE 10 PROTECTION OF TREES AND PROPERTY

Add the following after Article 10.5:

10.6 FLORIDA TRENCH SAFETY ACT

10.6.1 The Occupational Safety and Health Administration excavation safety standards, 29CFR 1926.650 Subpart B trench safety standards are in effect during the period of construction of the Project. In compliance with current State of Florida statutes, the Contractor or subcontractor performing trench excavation work on the Project shall comply with the applicable trench safety standards.

ARTICLE 11 INSURANCE AND BONDS

Article 11 of the AIA General Conditions as written is deleted in its entirety and is superseded as follows:

11.1 Definitions:

11.1.1 Contractor: As used in this Article 11, is the Contractor and any and all of his Subcontractors, employees, agents and representatives.

11.2 Builder's Risk Insurance: Owner shall purchase, maintain, and pay for the costs of Builder's Risk Insurance (fire, extended coverage, vandalism, theft, and malicious mischief) on all construction materials and the buildings or structures in the course of construction. Said Builder's Risk insurance shall insure to the benefit of Owner and Owner's interests. Said Builder's Risk insurance shall be subject to a $10,000.00 (ten thousand dollars) "deductible" clause. Contractor shall be responsible for paying for any and all losses up to said $10,000.00 deductible, excluding any loss which is the result of natural causes. Contractor shall be responsible for the loss of, or damage to, any and all of Contractor's personal property; such as tools, equipment, mobile office, etc.

11.2.1 Extended Coverage: The usual form currently available and covering perils of windstorm, hail, explosive, riot and civil commotion, damage from aircraft and vehicles and smoke damage.

11.3 Liability Insurance: The Contractor will purchase and maintain during the entire time of this Agreement comprehensive general liability and comprehensive automobile liability insurance as shall protect him from claims for property damages which may arise from operations under this Agreement whether such operations be by himself or by anyone directly or indirectly employed by him, and the amounts of such insurance shall be the minimum limits as follows:

11.3.1 Comprehensive General Liability including Personal Injury, Products Completed Operations Coverage, Independent Contractor's Protective, and Contractual Liability.

Bodily Injury and Property Damage:

$1,000,000 Each Occurrence
$5,000 Medical Payments (Any one person)
$1,000,000 Personal and Adv. Injury
$2,000,000 General Aggregate

$2,000,000 Products – Comp/OP Aggregate

General Aggregate Limit applies per Project; Products – Comp/OP Aggregate applies per Project; Waiver of Subrogation in favor of Owner.

Products and Completed Operations to be maintained for one (1) year after final payment.

Property Damage Liability Insurance will provide X, C, and U coverage when such contracts are affected. Owner shall be named as additional insured on all liability insurance.

11.3.2 Comprehensive Automobile Liability:

Combined Single Limit Each Accident	$1,000,000 – or –
Bodily Injury per Person	$1,000,000
Bodily Injury per Accident	$2,000,000
Property Damage per Accident	$1,000,000

Owner shall be named additional insured; Waiver of Subrogation in favor of Owner.

11.3 Worker's Compensation Insurance: Contractor shall take out and maintain, during the life of this Agreement, Worker's Compensation Insurance in compliance with Chapter 440, Florida Statutes, for all of his employees connected with the work of this project and further, the Contractor shall require his Subcontractors similarly to provide Worker's Compensation Insurance. In case any class of employee engaged in hazardous work under this Contract at the site of project is not protected under the Workmen's Compensation Statute, the Contractor shall provide adequate insurance satisfactory to the Owner for the protection of his employees not otherwise protected.

Required Limits:

1. Worker's Compensation - Statutory Benefits
2. Employer's Liability

$1,000,000 each employee	Bodily Injury by accident
$1,000,000 each employee	Bodily Injury by disease
$1,000,000 policy limit	Bodily Injury by disease

Waiver of Subrogation in favor of Owner.

11.4 Anything in the Contract Documents to the contrary notwithstanding and in addition to the insurance required to be maintained by the Contractor as hereinabove set forth, Contractor agrees to indemnify, hold harmless and defend Owner and Architect against any and all claims, loss, damage to or destruction of property including, without limitation, property and employees of Owner, occurring wholly or in part, as the result of work done or omitted to be done by, or contracted to be done but not done by, Contractor or his Subcontractors or the employees or agents or invites either arising from injury to or death of persons or damage to or destruction of property due or claimed to be due, in whole or in part, to any negligence or fault of Owner or its employees, agents, or invites, except claims, loss, damage, costs or expense resulting from risks as are hereinabove required to be insured by Owner.

11.5 Contractor shall submit to Owner before commencement of work, evidence of the above require insurance, which shall contain certification by the insurance companies that such insurance shall not be canceled or materially changed until at least ten (10) days prior to written notification being given to the Owner. The Form of Certificate shall be the standard "Accord" form, Certificate of Insurance. The Contractor shall furnish the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

11.6 Anything in Paragraphs 4.18.1, 4.18.2, and 4.18.3 of the General Conditions to the contrary of the indemnification obligations hereby set forth shall not be applicable as between the Owner and Contractor, and any and all references to Owner therein deleted.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

Delete Paragraph 12.2.2 in its entirety and add the following:

12.2.2 If, after the approval of final payments and prior to expiration of one (1) year thereafter, or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any work is found to be defective, it shall be repaired by the Contractor. In the case of an emergency, brought about by defective work of the Contractor, the Owner may proceed immediately to make the necessary repairs and charge the cost of same to the Contractor without giving any notice to the Contractor.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.6 INTEREST

Delete Paragraph 13.6.1

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 TERMINATION BY THE OWNER

Delete Paragraph 14.2.1 in its entirety and add the following:

14.2.1 If the Contractor is adjudged a bankrupt, or makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of the Contractor's insolvency, or if the Contractor persistently or repeatedly refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or fails to make prompt payment to Subcontractors for materials or labor, or persistently disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, or if the Contractor:

1. Fails to correct, replace and/or re-execute faulty or defective work and/or materials furnished under this Agreement; or

2. Fails to complete or diligently proceed with the Work required by this Agreement, within the time constraints of the construction schedule maintained by the Architect; or

3. Fails to correct or repair any damage to Work caused by him or his failure to protect his Work or the work of others; or

4. Fails to provide safe and sufficient facilities, orderly premises and the cleanup of the Work required under this Agreement; or

5. Is unable to proceed with the Work because of any action by one or more employees of the Trade Contractor or by a person or labor organization supporting or attempting to represent any employees of the Trade Contractor; or otherwise is guilty of a substantial violation of the provision of the Contract Documents, and fails within 72 hours after receipt of written notice to commence and continue correction of such default, neglect or violation with diligence and promptness, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may without prejudice to any other remedy the Owner may have, terminate the employment of the Contractor and take possession of the site and all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever methods the Owner may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished.

ARTICLE 15 CLAIMS AND DISPUTES

Add the following to Paragraph 15.1.4

Unless otherwise provided in the Contract Documents, cost shall be limited to the following: cost of material at the trade discount cost, including sales tax and cost of delivery; cost of labor, including Social Security, unemployment insurance, and fringe benefits required by agreement or custom; workers compensation insurance; bond premium not to exceed one percent (1%); rental value of equipment and machinery at trade discount cost plus sales tax and the additional cost of supervision directly attributable to the change only if the change (or total time extension of all changes) results in an extension of the contract time for more than thirty (30) days. The bond premium of all credit amounts shall be added to the total credit allowed the Owner. No bond cost shall be allowed for a Subcontractor's bond cost.

Add the following Clauses to Subparagraph 15.1.5

15.1.5.3 Claims for an increase in Contract Time shall set forth in detail the circumstances that form the basis for the claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the claim.

15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent delays due to the fault of the Contractor.

ARTICLE 16 - ADDITIONAL CONDITIONS (ADDED ARTICLE)

16.1 MINIMUM WAGE (NOT REQUIRED)

16.2 APPRENTICES AND TRAINEES

16.2.1 The Contractor shall conform to all requirements of Section 466.101 of the Florida Statutes with respect to apprentice and trainee employment.

16.3 EQUAL OPPORTUNITY

16.3.1 The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated fairly during employment without regard to their race, religion, color, sex, national origin, or age. Such action shall include, but not be limited to the following:

16.3.2 Employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination in accordance with local, state and federal guidelines.

16.4 PREFERENCE TO HOME INDUSTRIES

16.4.1 The Contractor agrees that, pursuant to Section §255.04, Florida Statutes, preference will be given in the purchase of material and in the letting of contracts for the construction of this project to the residents of the State whenever such material can be purchased or services can be employed at no greater expense than that which could be obtained if such purchase was made or contract let to a person or firm doing business beyond the limits of the State, provided that quality of materials, qualifications, character, responsibility and fitness be equal.

16.5 CODE REQUIREMENTS

16.5.1 All work under this Contract shall be completed in accordance with the Florida Building Code, 2007 Edition, with the 2009 Supplement and Florida State Requirements for Educational Facilities (SREF) 2007 and all subsequent addenda, as well as all local, County, State, and Federal laws, codes or requirements

WAIVER OF LIEN AND CERTIFICATION

St. Johns River State College
Palatka, Florida

KNOW ALL MEN BY THESE PRESENTS, that _____

_____

for and in consideration of _____ Dollars, and other good and valuable considerations, lawful money of the United States of America, to me in hand paid, the receipt whereof is hereby acknowledged, does hereby waive, release, remise and relinquish any and all right to claim any lien or liens for work done or material furnished, or any kind of class of lien whatsoever on the following described property:

DATED this ____day of _____, 20_____,

at_____.

BY:_____

TITLE:_____

Sworn to and Subscribed to before me this _____day of _____,20____.

_____
NOTARY PUBLIC
MY COMMISSION EXPIRES:

NOTARY SEAL

_____
(Date)

END OF SECTION

SECTION 00900

ADDENDA AND MODIFICATIONS

PART 1 – GENERAL

1.1 ADDENDA

A. Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which may modify or interpret the Bidding Documents by additions, deletions, clarifications, or corrections.

B. Addenda prepared prior to issuance of the Project Manual are included or referenced at the end of this document.

C. Addenda prepared after the issuance of the Project Manual should be added for reference at the end of this document.

D. All addenda shall be acknowledged by the Bidder on the Bid Form.

E. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification sections apply to this section.

1.2 MODIFICATIONS

A. See General Conditions, Article 1 for the complete definition of modifications

B. Modifications, if inserted into the Project Manual, should be located at the end of this document.

PART 2 – PRODUCTS (*Not used*)

PART 3 – EXECUTION (*Not used*)

END OF SECTION

SECTION 01020

ALLOWANCES

1.1 Lump Sum Allowances

A. Selection and Purchase: At the earliest feasible date after Contract award, advise the Architect of the date when selection and purchase of each product or system described by an allowance must be completed to avoid delay.

B. When requested by the Architect, obtain proposals for each allowance for use in making final selections; include recommendations that are relevant to performance of the work.

C. Purchase products and systems from the designated supplier.

D. Submittals: Submit proposals for purchase of products or systems included in allowances, in the form of Change Orders.

1. Submit invoices or delivery slips to indicate quantities of materials delivered for use in fulfillment of each allowance.

E. Inspection: Inspect products covered by an allowance promptly upon delivery for damage or defects.

F. Preparation: Coordinate materials and installation for each allowance with related materials and installations to ensure that each allowance item is integrated with related construction activities.

G. Installation of allowance item shall be included in Project's Base Bid or appropriate alternate bid.

1.2 Schedule of Allowances:

(TBA)

END OF SECTION

SECTION 01070

ALTERNATES

PART I - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies administrative and procedural requirements for Alternates.

B. Definition: an Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of the construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related work and modify or adjust adjacent work as necessary to ensure that work affected by each accepted alternate is complete and fully integrated into the project.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each alternate. Indicate whether alternate have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates.

E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the work described under each alternate.

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 mentioned as part of the alternate.

SCHEDULE OF ALTERNATES:

BID ALTERNATE NO. 1	(ADDITIVE) Re-roofing of Building V
BID ALTERNATE NO. 2	(ADDITIVE) Building V AHU Replacement
BID ALTERNATE NO. 3	(ADDITIVE) Exterior ADA Ramped Walkway from Lobby/Gallery to Parking Lot
BID ALTERNATE NO. 4	(ADDITIVE) Add pre-cast concrete decorative columns at Lobby/Gallery to cover painted steel tube columns.
BID ALTERNATE NO. 5	(ADDITIVE) Add polished concrete floor finish at Lobby/Gallery, in place of VCT Flooring.
BID ALTERNATE NO. 6	(ADDITIVE) Replace VCT flooring in Building V

END OF SECTION

SECTION 01090

DEFINITIONS AND STANDARDS

A. Definitions:

1. General: Except as specifically defined otherwise, the following definitions supplement definitions of the Contract, General Conditions, Supplementary Conditions and other general contract documents, and apply generally to the work.

2. General Requirements: The provisions of Division-1 sections, General Requirements, apply to the entire work of the Contract.

3. Indicated: Shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

4. Directed, Requested, Approved, Accepted, etc.: These terms imply "by the Architect/Engineer", unless otherwise indicated.

5. Approved by Architect/Engineer: In no case releases Contractor from responsibility to fulfill requirements of contract documents.

6. Project Site: Space available to Contractor at location of project, either exclusively or to be shared with separate contractors, for performance of the work.

7. Furnish: Supply and deliver to project site, ready for unloading unpacking, assembly, installation, and similar subsequent requirements.

8. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar requirements.

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

10. Installer: Entity (firm or person) engaged to install work by Contractor, subcontractor or sub-subcontractor. Installers are required to be skilled in work they are engaged to install.

11. Specification Text Format: Underscoring facilities scan reading, no other meaning, imperative language is directed at Contractor, unless otherwise noted.

12. Overlapping/Conflicting Requirements: Most stringent (generally) requirement written directly into the contract documents is intended and will be enforced, unless specifically detailed language written into the contract documents clearly indicates that a less stringent requirement is acceptable. Refer uncertainties to the Architect/Engineer for a decision before proceeding.

13. Minimum Requirements: Indicated requirements are for a specific minimum acceptable level of quality/quantity, as recognized in the industry. Actual work must comply (within specified tolerances), or may exceed minimums within reasonable limits. Refer uncertainties to Architect/Engineer before proceeding.

14. Abbreviations, Plural Words: Abbreviations, where not defined in contract documents, will be interpreted to mean the normal construction industry terminology, determined by recognized grammatical rules, by the Architect/Engineer. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of contract documents.

15. Testing Laboratory: An independent entity engaged for the project to provide inspections, tests, interpretations, reports and similar services.

B. Standards and Regulations:

1. Industry Standards: Applicable standards of construction industry have same force and effect on performance of the work as if copies directly into contract documents or bound and published therewith. Standards referenced in contract documents or in governing regulations have precedence over non-referenced standards, insofar as different standards may contain overlapping or conflicting

requirements. Comply with standards in effect as of date of contract documents, unless otherwise indicated.

a. Abbreviations: Where abbreviations or acronyms are used in contract documents, they mean the well recognized name of entity in building construction industry; refer uncertainties to Architect/Engineer before proceeding, or consult “Encyclopedia of Associations" by Gale Research Co.

2. Trade Union Jurisdictions: Maintain current information on jurisdictional matters, regulations, actions and pending actions; and administer/supervise performance of work in a manner which will minimize possibility of disputes, conflicts, delays, claims or losses.

END OF SECTION

SECTION 01100

SUMMARY OF THE WORK

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. This Section includes the following:

1. Work covered by the Contract Documents
2. Type of the Contract
3. Owner-furnished products
4. Use of premises
5. Owner's occupancy requirements
6. Work restrictions
7. Specification formats and conventions

B. Related Sections include the following: Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Renovations to Building S and Building V, St. Johns River State College, Orange Park Campus. Project Location: 283 College Drive, Orange Park, Clay County, Florida

B. Owner: District Board of Trustees, St. Johns River State College, 5001 St. Johns Avenue, Palatka, Florida

C. Architect: CRG Architects/Palatka, Inc., 216A St. Johns Avenue, Palatka, Florida, 32177

D. The Work consists of interior demolition and renovation of Building S, the addition of an enclosed Lobby/Gallery connecting Buildings S and V, re-roofing of Building V, replacement of handicapped main exterior walk, replacement of HVAC equipment serving Building V, and other minor additions.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single-prime contract.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present and assist in Owner's inspection.

4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples, and return them to Architect, noting all discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading and handling Owner-furnished items at Project Site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-furnished Products:

1. General Building Items: N/A
2. Lab Equipment: N/A
3. Toilet accessories including paper towel dispensers, toilet tissue dispensers, liquid soap dispensers and feminine napkin disposal units. Note: Contractor will be responsible for installation of all toilet accessories.

1.6 USE OF PREMISES

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

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

1. Owner Occupancy: Allow for Owner occupancy of the area surrounding the Project site and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials

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

1.7 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy adjacent site areas and adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. On-site Work Hours: Work shall generally be performed as required by St. Johns River State College.

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

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's permission.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "Master Format" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjective mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted. The words "shall", "shall be", or "shall comply with" depending on the context, are implied where a colon is used within a sentence or a phrase.

END OF SECTION

SECTION 01110

UNIT PRICES

1.1 Requirements

A. Unit prices for work described in this Section shall be used for additions and/or deletions to the Contract.

B. The cost of this work shall include all labor and materials, delivery to site, handling at site, protection from elements, and Construction Manager and subcontractor's overhead and profit.

C. Unit prices shall be listed in the Bid Proposal form.

1.2 Schedule of Unit Prices:

A. Unit Price "A" - 1/2" Plywood Sheathing (Bid Alt. 1 – Re-roofing of Building V)

1. Description: Unit Price shall include all labor and material costs for replacement of plywood sheathing.
2. Unit of Measurement: The unit price shall be entered on the Bid Form as cost per 100 square feet.

B. Unit Price “B” – Pressure-Treated 2x4 Replacement:

1. Description: Unit Price shall include all labor and material costs for pressure-treated 2x4 replacement, cut to shape as required.
2. Unit of Measurement: The unit price shall be entered on the Bid Form as cost per 100 lineal feet.

C. Unit Price “C” – Pressure-Treated 2x6 Replacement:

1. Description: Unit Price shall include all labor and material costs for pressure-treated 2x6 replacement, cut to shape as required.
2. Unit of Measurement: The unit price shall be entered on the Bid Form as cost per 100 lineal feet.

D. Unit Price “D” – Pressure-Treated 2x10 Replacement:

1. Description: Unit Price shall include all labor and material costs for pressure-treated 2x10 replacement, cut to shape as required.
2. Unit of Measurement: The unit price shall be entered on the Bid Form as cost per 200 lineal feet.

E. Unit Price “E” – Pressure-Treated 2x12 Replacement:

1. Description: Unit Price shall include all labor and material costs for pressure-treated 2x12 replacement, cut to shape as required.
2. Unit of Measurement: The unit price shall be entered on the Bid Form as cost per 25 lineal feet.

END OF SECTION

SECTION 01250

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1.1 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. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:

1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

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. 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 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.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes 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 Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 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. 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. 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 01290

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:

1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Contractor's construction schedule.

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

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

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

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

        1) Labor
        2) Materials.
        3) Equipment

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

4. Round amounts to nearest whole dollar; total shall equal the value of the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

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

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

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

B. The Architect/Engineer shall monitor and verify progress of Record Documents prior to approval of Contractor’s monthly Application for Payment.

C. Payment Application Times: the date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

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

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of approved Change Orders and Construction Change Directives issued before last day of construction period covered by application.

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

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner and Florida State Statutes.

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

1. List of subcontractors.
2. Schedule of values
3. Contractor's construction schedule
4. Products List
5. Submittals Schedule
6. List of Contractor’s staff assignments
7. List of Contractor’s principal consultants
8. Copies of building permits
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the work.
10. Initial progress report
11. Report of pre-construction conference.
12. Certificates of insurance and insurance policies
13. Performance and payment bonds
14. Data needed to acquire Owner’s insurance.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Submit Florida Department of Education Certificate of Substantial Completion.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (*Not Used*)

PART 3 - EXECUTION (*Not Used*)

END OF SECTION 01290

SECTION 01310

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Coordination Drawings.

2. Administrative and supervisory personnel.

3. Project meetings.

1.3 COORDINATION

A. It shall be the Contractor's responsibility to keep various municipalities and authorities having jurisdiction updated of any addenda, change orders, or plan revisions that will affect the permit-approved set of plans.

B. Coordination: Coordinate construction operations included in various 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service and repair of all components, including mechanical and electrical.

C. 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.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information as applicable.

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical and electrical systems
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered for changes in the Contract.

2. Refer individual sections for Coordination Drawing requirements in those sections.

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 and office telephone numbers. Keep list current at all times. Provide a Superintendent acceptable to Owner and Architect.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

A. 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: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

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

    a. Tentative construction schedule.

    b. Critical work sequencing and long-lead items.

    c. Quality and Work Standards

    d. Designation of key personnel and their duties.

    e. Procedures for processing field decisions and Change Orders.

    f. Procedures for processing requests for interpretations (RFI's)

    g. Procedures for testing and inspecting.

    h. Procedures for processing Applications for Payment.

    i. Distribution of the Contract Documents.

    j. Direct purchase requirements.

    k. Submittal procedures.

    l. Preparation of Record Documents.

    m. Use of the premises.

    n. Work restrictions

    o. Owner's occupancy requirements

    p. Responsibility for temporary facilities and controls.

    q. Construction waste management and recycling

    r. Parking availability.

    s. Office, work, and storage areas.

    t. Equipment deliveries and priorities.

    u. First aid.

    v. Security.

    w. Progress cleaning.

    x. Working hours.

3. Minutes: Record and distribute meeting minutes

4. Contractor shall be responsible to keep the authorities having jurisdiction updated of any Addenda, Change Orders, or Plan Changes that will affect the Permit Approved set of plans.

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 of scheduled meeting dates.

2. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

4. 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. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. 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. Review schedule for next period.

b. Review present and future needs of each entity present

3. Record the meeting minutes.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01320

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Preliminary Construction Schedule.

2. Contractor's Construction Schedule.

3. Submittals Schedule.

4. Material location reports.

5. Field condition reports.

6. Special reports.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.

2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.

3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.

4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

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

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

2. Predecessor activity: An activity that precedes another activity in the network.

3. Successor Activity: An activity that follows another activity in the network.

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

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

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

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

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

1. Float time is not for the exclusive use or benefit of the Owner or Contractor but it is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

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

1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.

2. Specification Section number and title.

3. Submittal category (action or informational).

4. Name of subcontractor.

5. Description of the Work covered.

6. Scheduled date for Architect's final release or approval.

C. Preliminary Construction Schedule: Submit four opaque copies. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

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

1. Activity report: List of all activities sorted by activity number and then early start date, or actual start date if known.

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

3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Material Location Reports: Submit two copies at weekly intervals.

F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

G. Special Reports: Submit two copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.

2. Verify availability of qualified personnel needed to develop and update schedule.

3. Discuss constraints, including area separations, interim milestones.

4. Review delivery dates for Owner-furnished products.

5. Review schedule for work of Owner's separate contracts.

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 completion and startup procedures.

9. Review and finalize list of construction activities to be included in schedule.

10. Review submittal requirements and procedures.

11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

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

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

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

2. Initial Submittal: Submit concurrently with preliminary construction schedule. Include submittals required during the first 60 days of construction. List those 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.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning and Scheduling

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal 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 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 Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

4. Startup and Testing Time: Include not less than two 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.

D. 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. Owner Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary". Delivery dates indicated stipulate the earliest possible delivery dates.

2. Work Restrictions: Show the effect of the following items on the schedule:

   a. Coordination with existing construction.

   b. Uninterruptible services.

   c. Partial occupancy after Substantial Completion.

   d. Use of premises restrictions.

   e. Seasonal variations.

   f. Environmental control.

3. 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. Mock-ups

   e. Fabrications

   f. Sample Testing

   g. Deliveries

   h. Installation

   i. Tests and inspection

   j. Adjusting

   k. Curing

   l. Startup and placement into final use and operation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.

2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal 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 five percent of the Contract Sum.

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

H. Computer Software: Prepare Schedules using a program that has developed specifically to manage construction schedules.

2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

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

B. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, 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 30 days after date established for Notice to Proceed. 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 schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractor's 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. Include list of non-working days and holidays incorporated into the schedule.

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

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

a. Preparation and processing of submittals.

b. Mobilization and demobilization

c. Purchase of materials

d. Delivery

e. Fabrication

f. Utility interruptions

g. Installation

h. Work by Owner that may affect or be affected by Contractor's activities.

i. Testing and commissioning.

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 on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Initial Issue of Schedule: Prepare initial network diagram from a list of 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. Principal events of activity

4. Immediate preceding and succeeding activities

5. Early and late start dates.

6. Early and late finish dates

7. Activity duration in work days

8. Total float or slack time

9. Average size of workforce

10. Dollar value of activity (coordinated with Schedule of Values)

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

1. Identifications 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

F. 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.

2.5 REPORTS

A. Material Location Reports: At weekly intervals, prepare 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.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. 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 Actual Completion percentage for each activity.

B. 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 01320

SECTION 01330

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.

2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.

3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for erecting mockups.

5. Division 1 Section "Closeout Procedures" for submitting warranties

6. See Division 1 Section “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data

7. See Division 1 Section “Operation and Maintenance Data” for submitting operation and maintenance manuals.

8. Division 1 Section “Demonstration and Training” for submitting video of demonstration of equipment and training of Owner’s personnel.

9. Divisions 2 through 16 Sections for specific requirements for submittals in those sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

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. 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.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

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

1. Initial Review: Allow 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.

2. Resubmittal Review: Allow 15 days for review of each submittal.

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

4. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Contractor.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6” x 8” on label or beside title block to record Contractor’s review and approval markings and action taken by Architect.

3. Include the following information on label for processing and recording action taken:

a. Project name.

b. Date.

c. Name and address of Architect.

d. Name and address of Contractor.

e. Name and address of supplier.

f. Name of manufacturer.

g. Submittal number or other unique identifier, including revision identifier. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01) Resubmittals

shall include an alphabetic suffix after another decimal point (e.g. 06100.1.A)

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

j. Location where product is to be installed, as appropriate.

k. Other necessary identification.

F. For Product Data or similar submittals where a label or title block may not be easily included or affixed, the Contractor may use a submittal cover sheet.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals received from sources other than the Contractor without review

1. Transmittal Form: Provide locations on form for the following information:

a. Project name

b. Date

c. Destination (TO)

d. Source (FROM)

e. Names of subcontractor, manufacturer and supplier

f. Category and type of submittal

g. Submittal purpose and desorption

h. Submittal and transmittal distribution record

i. Remarks

j. Signature of transmitter

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

J. Resubmittals: Make resubmittals in the same number of copies as initial submittal.

1. Note date and content of previous submittal

2. Note date and content of revisions in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked “Reviewed” or “Furnish As Corrected”

K. 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.

L. Use for Construction: Use only final submittals with mark indicating “Reviewed” or ““Furnish as Corrected” action taken by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual Specification Sections.

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 printed 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 written recommendations.

b. Manufacturer's product specifications.

c. Manufacturer's installation instructions.

d. Standard color charts.

e. Manufacturer's catalog cuts.

f. Wiring diagrams showing factory-installed wiring.

g. Printed performance curves.

h. Operational range diagrams.

i. Mill reports.

j. Standard product operation and maintenance manuals.

k. Compliance with specified referenced standards.

l. Testing by recognized testing agency.

m. Application of testing agency labels and seals.

n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples

5. Number of Copies: Submit four copies of Product Data. Submit six copies where copies are required for Operation and Maintenance Manuals. Architect will retain two copies (one for file, one for Owner); remainder will be returned. Contractor shall mark up and retain one returned copy as a Project Record Document.

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.

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

a. Dimensions.

b. Identification of products.

c. Fabrication and installation drawings.

d. Roughing-in and setting diagrams.

e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.

f. Templates and patterns.

g. Schedules.

h. Design calculations.

i. Compliance with specified standards. Provide the applicable product approval numbers or certify that products conform to the Florida Building 2007. The list of products is as follows: Exterior doors, windows, roofing products, structural components, and other products as applicable.

j. Notation of coordination requirements.

k. Notation of dimensions established by field measurement.

l. Relationship to adjoining construction clearly indicated.

m. Seal and signature of professional engineer if specified.

n. Wiring diagrams: Differentiate between manufacturer-installed and field installed wiring.

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

3. Number of Copies: Submit four opaque copies of each submittal. Submit six copies where are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Contractor shall mark up and retain one returned print as a Project Record Drawing**.**

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a final 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 Sample that includes the following

    a. Generic description of Sample

    b. Product name and name of manufacturer

    c. Number and title of appropriate Specification Section.

3. 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.

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

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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. Number of Samples: Submit three sets of Samples. Architect will retain on Sample set; remainder will be returned. Mark up and retain one retuned Sample set as a Project Record Sample.

    a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

    b. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.

E. Product Schedule or List: 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.

2. Number and name of room or space.

3. Location within room or space.

4. Number of Copies: Submit four copies of product schedule or list, unless otherwise indicated. Architect will return three copies. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for Contractor's action.

G. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

J. 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 entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated Architect will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.

3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination"

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

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

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

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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

K. Research/Evaluation Reports: Prepare 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.

L. Schedule of Tests and Inspections; Comply with requirements specified in Division 1 Specification Section “Quality Requirements”

M. Preconstruction Test Reports: Prepare 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.

N. Compatibility Test Reports: Prepare 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.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section “Operation and Maintenance Data."

Q. Design Data: Prepare 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.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.

2. Required substrate tolerances.

3. Sequence of installation or erection.

4. Required installation tolerances.

5. Required adjustments.

6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.

6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

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

2.3 DELEGATED DESIGN

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

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit four copies of a statement, signed and sealed by the responsible design

professional for each product and system specifically assigned to Contractor to be designed or certified by a Design Professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include lists of codes, loads and other factors used in performing these services. Three copies shall be returned.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. 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. 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. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action to be taken, as follows:

1. Final Unrestricted Release: Where submittal is marked “Reviewed”, the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend upon that compliance.

2. Final-but-Restricted Release: Where submittal is marked “Furnish as Corrected”, the Work covered by the submittal may proceed, provided it complies with both Architect’s notations and corrections in the submittal and the Contract Documents. Final acceptance will depend on that compliance.

3. Return for Resubmittal: Where the submittal is marked “Revise and Resubmit”, do not proceed with the Work covered by the submittal, including purchasing, fabrications, delivery or other activity for the product submitted. Revise or prepare a new submittal according to Architect’s notations and corrections.

4. Rejected: Where the submittal is marked “Rejected”, do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

5. Incomplete: Where the submittal is marked “Submit Specified Item”, do not proceed with the Work covered by the submittal. Prepare additional information requested or required by the Contract Documents that indicate compliance with requirements.

6. Other Action: If the submittal is primarily for informational purposes, special processing, or other Contractor activity, the submittal will be returned marked “Action Not Required”.

C. 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.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

F. Submittals shall be approved prior to fabrication or installation of systems or equipment.

END OF SECTION

SECTION 01400

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This 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 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.

C. Related Sections include the following:

1. Division 1 Section “Construction Progress Documentation” for developing a schedule of required tests and inspections.

2. Division 1 Section “Cutting and Patching” for repair and restoration of construction disturbed by testing and inspecting of activities.

3. Divisions 2 – 16 Sections for specific test and inspection requirements.

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 ensure 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 example assemblies that are constructed on site. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction,

coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

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

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

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

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

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

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as employee, Subcontractor, of Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations. Using a term such as “carpentry” does not imply that certain construction activities must be performed accredited or unionized individuals of a corresponding generic name, such as “carpenter”. It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

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

1.4 CONFLICTING REQUIREMENTS

A. 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 uncertainties and 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. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: 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.

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

1. Specification Section number and title

2. Description of test and inspection

3. Identification of applicable standards

4. Identification of test and inspection methods.

5. Number tests and inspections required

6. Time schedule or time span for tests and inspection

7. Entity responsible for performing tests and inspection

8. Requirements for obtaining samples

9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that 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 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 retesting and reinspecting.

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.

1.6 QUALITY ASSURANCE

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

B. 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.

C. 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.

D. 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.

E. Professional Engineer Qualifications: A professional Engineer who is legally qualified to practice in the 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 products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications 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. Requirement for specialists shall supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP or independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; 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. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design and extent to those indicated for this Project.

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

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.

e. Build laboratory mockups at testing facility using personnel, products and methods of construction indicated for the completed Work.

f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory 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.

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

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

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

3. Demonstrate the proposed range of aesthetic effects and workmanship

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction. Allow seven days for initial review and each re-review of each mockup.

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

6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 – 16.

1.7 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 the 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.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. 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.

1. Where services indicated are Contractor's responsibility, engage a qualified testing agency to perform those quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by the Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that required testing or inspecting will be performed.

3. Where quality-control services are indicated as Contractor's responsibility, submit a written certified report, in duplicate of each quality control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

5. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures"

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

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

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

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

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

4. Submit a certified written report in duplicate of each test, inspection, and similar quality-control service through Contractor.

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

6. Do not perform any duties of Contractor.

F. Associated Services: 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:

1. Access to the Work.

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

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

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

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

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

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

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of the date established for Notice to Proceed. Distribution: Distribute to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections required.

1.8 SPECIAL TESTS AND INSPECTIONS

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

1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviewing 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 authorities having jurisdiction.

4. Submitting a final report of special tests and inspection at Substantial Completion that shall include 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 Contract Documents.

6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. 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 modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes. Comply with the Contract Document requirements of Division 1 Section "Cutting and Patching"

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

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

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROL

PART I - GENERAL

1.1 DURATION

All facilities required as part of this section shall be provided and maintained for duration of project or as specifically required.

1.2 TEMPORARY UTILITIES

A. The Contractor is responsible for the following:

1. Temporary telephone service. (Contractor's option)
2. Temporary field offices. (Contractor's option)
3. Temporary toilets, including disposable supplies.
4. Temporary wash facilities, including disposable supplies.
5. Drinking water.
6. Temporary daily janitorial services.
7. Construction aids and miscellaneous services and facilities.
8. Barricades, warning signs and lights.
9. Security enclosure and lockup.
10. Environmental protection.
11. Temporary electric and water will be furnished by owner, from the existing facilities.

1.3 BARRIERS

A. Contractor shall provide as needed or required and comply with applicable governmental requirements for barricades, lighting, marking, flagmen, etc., to protect work, property and persons.

B. Dust proof partitions shall be provided during demolition and renovation construction activity and at other times as required to prevent spread of dust and debris into other areas of the Business Offices where no work is scheduled and other areas of the building.

1.4 TEMPORARY CONTROLS

A. Environmental Requirements: Comply with all governmental requirements as such affects work hereunder.

B. Noise: Construction noise shall be kept to a minimum.

C. Debris Control: Keep premises clean and free from accumulation of debris and rubbish. Provide trash and debris receptacles and require use. Remove from site daily.

D. Entrance lobby shall remain operational during construction of this project.

1.5 PROJECT SAFETY

Contractor shall comply with all applicable governmental and insuring company requirements relative to construction and project safety. Either the superintendent, or other company representatives shall be on the site during all working hours. This person shall be trained in project safety and designated as Contractor's Safety Director.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REFERENCED DOCUMENTS

A. References to standards or specifications such as Federal, ASTM, ANSI, etc., shall be latest edition in effect on the date of this Project Manual except where specific issues are noted.

B. Reference to such thereby makes them a part of this Project Manual as if bound herein. The Architect's approval shall be required where use of an edition other than referenced is desired. Provide completion information as to request.

1.02 PROPRIETARY PRODUCTS AND SUBSTITUTIONS

A. Where products of one or more manufacturers are listed as approved, such designated products shall be furnished unless a written request for a substitution is made and approved by the Architect.

B. Approved products shall be considered equivalent regardless of listing. Request and reason for substitution shall be through the Contractor to the Architect fully describing item, material, or system. Such information shall include any and all adjustments to that or any other work, and shall state credit or extra involved. If samples are requested, such shall be provided. The Architect will review data, judging quality, workmanship, economy of operation and general suitability for purpose a compared with that specified and shall advise in writing as to acceptance or rejection. No change shall be made without written approval from the Architect.

1.03 NON-PROPRIETARY PRODUCTS AND SUBSTITUTIONS

A. Performance specifications establish minimum standards for all competitors.

B. Construction Documents may reference a product that meets such requirements, but such reference is for information only and not proprietary in intent.

C. Request for substitutions shall be as outlined under paragraph 1.02 "Proprietary Products and Substitutions".

1.04 PRODUCT DELIVERY AND STORAGE

A. Delivery:

1. Deliver products, subject to delivery or storage damage in packages, containers, bundles or on pallets as applicable to protect from damage, adulteration or loss.

2. Each shall bear manufacturer's name, product name and/or type, along with sufficient data to determine that such complies with the Contract Documents.

3. Where labels of testing agencies or associations are required, such shall be affixed to products prior to leaving point of manufacture.

B. Storage:

1. Determine and comply with requirements or recommendation relative to safety and precautions in storage of products.

2. Ascertain that stored materials do not exceed structural limitations of areas on which stored.

3. Keep materials stacked, well ventilated, covered and protected against water, displacement by the elements and damage.

4. Stack on supports of adequate strength and spacing not to damage or deform materials stored thereon or supporting substrate.

5. Provide sufficient clearance from supporting substrate to assure adequate drainage and no contact with water or moist surfaces.

6. Where stored inside, provide protective covering over supporting substrate to protect against spillage, etc.

1.04 PAYMENT FOR STORED MATERIAL

A. Material stored, but not incorporated in the work, and for which Contractor desires payment prior to incorporation must be stored to protect Owner's interest.

B. Storage shall be at the site and fully insured or in an approved warehouse with evidence of insurance and consent of surety provided. Method of storage, location and proof that owner's interest is protected is required a time of submitting application for payment.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

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

1. Construction layout.
2. Field Engineering and Surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.3 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.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Existing Utilities: 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 and other construction affecting the Work.

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

C. Acceptance of Conditions: 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    a. Description of the Work
    b. List of detrimental conditions
    c. List of unacceptable installation tolerances.
    d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

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

B. 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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. 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 invert elevations.

D. Building Lines and Levels: Locate and layout 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 members, and types of instruments and tapes used. Make the log available for referenced by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks.

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 operation.

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 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 size and type 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.

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 8 feet (2.4 m) in spaces without a suspended ceiling.

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

F. 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.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

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.

H. 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.

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

3.6 OWNER-INSTALLED PRODUCTS

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

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

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

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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. Broom-clean or vacuum the entire work area each day.

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: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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.

3.8 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturers written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching." Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01731

CUTTING AND PATCHING

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. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Divisions 2 – 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

2. Division 7 Section “Through-Penetration Firestop Systems” for patching fire-rated systems.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

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

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect; list services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements without first contacting the Architect for approval.

B. Operational and Safety Elements: Do not cut and patch the following operating elements and safety 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.

C. Miscellaneous Elements: Do not cut and patch the following elements or related 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.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.

E. 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.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

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

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. 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. Cutting: Cut existing 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 as small as possible, neatly to 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 toward the 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 Division 2 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.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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 eliminate 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 to 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.

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

5. Ceilings: Patch, repair or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 01770

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section “Payment Procedures” for requirements for Applications for Payment for Substantial Completion and Final Completion
2. Division 1 Section “Execution Requirements” for progress cleaning of Project Site
3. Division 1 Section “Project Record Documents” for submitting Record Drawings, Record Specifications, and Record Product Data
4. Division 1 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.
5. Division 1 Section “Demonstration and Training” for requirements for instructing Owner’s personnel.
6. Divisions 2 – 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. 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.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. 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. Contractor will be charged for Architect’s, Consulting Engineer’s, and Owner’s time occurred to re-inspect incomplete work.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies 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

1.6 WARRANTIES

A. Submittal Time: 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.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction indicated.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
    1. Bind warranties and bonds in heavy-duty, 3-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.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health, property, the environment, or that may damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Provide 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 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. 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.

f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

g. Sweep concrete floors broom clean in unoccupied spaces.

h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

j. Remove labels that are not permanent.

k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

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. Replace parts subject to unusual operating conditions.

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

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

p. Clean ducts, blowers, and coils if units were operated without filters during construction. Operation of units without filters is not permitted.

q. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove all waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 01781

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. State Fire Marshall Approval Documents
5. Samples

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up Record Prints.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings continuously during the construction period.

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 prepare the 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 understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

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. Location 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 or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

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. Format: Identify and date each Record Drawing; include the designation “RECORD SET” 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. Identification: As follows

a. Project name

b. Date

c. Designation “RECORD SET”

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.

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.

2.4 RECORD SAMPLES

A. Contractor shall maintain at the site samples and similar required submittals. These shall be available to the Architect/Engineer and the Owner and shall be delivered to the Architect/Engineer for submittal to the Owner upon completion of the work.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Contractor shall maintain on-site set of the State Fire Marshall-approved documents.

B. 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.

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 modifications to Project Record Documents as they occur; do not wait until the end of Project. Architect/Engineer shall monitor and verify progress of record documents prior to approval of Contractor’s monthly applications for payment.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01782

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This 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. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection. Correct or modify each manual to comply with Architect's comments. Submit 4 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

B. Operation and Maintenance documentation shall contain accurate “Record Set” information to permit the College Maintenance personnel to take over maintenance with instructions sufficient to ensure operation and maintenance in accordance with manufacturer’s specifications.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: 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 MANUALS, GENERAL

A. Manuals shall contain only information on systems and products installed.

B. 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.

C. Title Page: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

D. 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.

E. 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.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1 /2-by-11 -inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11 -inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

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.
2. Performance and design criteria if Contractor is 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.
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 MANUAL

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.

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. Contractor shall consolidate manufacturers schedules with a single master schedule for required maintenance

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. 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 MANUAL

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.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the-following information for each component part or piece of equipment:

1. Standard printed 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 videotape, 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. 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 Division 1 Section "Project Record Documents.",

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01820

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 1 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.

B. Related Sections:

1. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

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 utilizing 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 instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, three-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

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 as required by the contract documents:

1. Operational and Maintenance Requirements, and Criteria: Include the following:

   a. Calibration Strategy for Outdoor and Exhaust Dampers.
   b. Carbon Dioxide Monitoring Protocol.
   c. Carbon Monoxide Monitoring Protocol.
   d. Chemical Management and Minimization Policy.
   e. Energy Metering Report Plan.
   f. Low Impact Site and Green Building Exterior Management Plan.
   g. Operation Schedule for all EPA Water Sense/Smart Water Applications, Smart Controllers and Rain Shut off Devices.
   h. Integrated Pest Management Plan.
   i. Site Maintenance Contracts.
   j. Waste Minimization Pan.
   k. Water Efficiency and Verification Plan.
   l. Schedule for HVAC and Filter Maintenance.
   m. General Sustainable Housekeeping.

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 Division 1 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

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.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

E. Pre-Produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01820

SECTION 02070

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section includes the following:

1. Demolition and removal of selected site elements.
2. Demolition and removal of selected interior and exterior construction.

B. Related Sections:

1. Division 2 Section “Site Clearing” for site clearing and removing above- and below-grade improvements.
2. Division 2 Section “Earthwork” for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner’s property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner’s property. Remove, clean and protect against damage. Deliver items as directed by Owner to locations on Campus.

C. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. All site landscaping damaged during the construction phase shall be restored by the Contractor at the closeout of the job.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner’s property, demolished materials shall become the Contractor’s property and shall be removed from the site with further disposition at the Contractor’s option.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

C. Record drawings at Project Closeout according to Division 1 Section “Project Closeout”

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Storage or sale or removed items or materials on-site will not be permitted.

1.8 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 – PRODUCTS (Not Applicable)

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 – EXECUTION

3.1 EXAMINATION

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

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

C. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction.

a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect and seal or cap off indicated utility services serving building to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

C. Utility Requirements: Refer to Division 15 and 16 Section for shutting off, disconnecting, removing and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Protect walls, ceilings, floors and other existing finish work that are to remain and are exposed during selective demolition operations.

3.3 POLLUTION CONTROLS

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

B. Clean adjacent surfaces and improvements of dust, dirt and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

C. Provide dust control for the affected portion of the Buildings included in this project.

3.4 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes, plumb, square and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
3. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
4. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

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

3.5 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Division 1 Section “Cutting and Patching”

C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow materials to accumulate on site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner’s property and legally dispose of them.

3.7 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION

SECTION 02104

PROTECTION OF SHRUBS AND TREES

PART 1 - GENERAL

1.1 SCOPE

The work under this section includes the furnishings of all labor, materials, tools and equipment necessary to properly preserve, protect and maintain trees and shrubs adjacent to the work that are not to be removed.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING TREES AND SHRUBS

A. The Contractor shall provide barriers to enclose the trunks of trees and shrubs adjacent to his work that are not to be removed. The Contractor shall protect them from injury from piled material, from equipment, from his operations, or other functions of work. Excavating machinery and cranes shall be of suitable type and size and so operated with care to prevent injury to trees not to be removed especially to overhanging branches and limbs.

B. Cutting of branches, limbs and roots shall be subject to the approval of the Architect, and shall be paid for by the Contractor. All cutting shall be smoothly and neatly done without splitting or crushing. In cases of cutting or unavoidable injury to branches, limbs, or trunks of trees, the cut or injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint. All tree trimming and cutting of trees are to be done by a qualified and approved tree surgeon and shall be paid for by the Contractor.

C. The Contractor shall notify the Owner of the project at least two weeks prior to the beginning of construction so that he may remove any trees, shrubs, sod, etc., from the construction area.

D. At the completion of the project, the Contractor shall restore the landscaping including lawn areas to their pre-construction condition.

END OF SECTION

SECTION 02220

BUILDING EXCAVATION AND FILL

PART I GENERAL

1.1 DESCRIPTION

A. The extent of building excavation and fill is shown on the drawings. Included is preparation or subgrades for slabs and foundations within the general building area and exterior walks.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Engage an independent soil testing and inspection service acceptable to the Architect/Engineer to perform a soil survey for satisfactory soil materials, sampling and testing soil materials proposed for use in the work, and field testing facilities for quality control during earth work operations.

C. Tests for Proposed Soil Materials:

1. Test soil materials proposed for use in the work and promptly submit test result reports.
2. Provide one (1) optimum moisture-maximum density curve for each type of soil encountered in subgrade and fills under building slabs and foundations. Determine maximum densities in accordance with ASTM D1557.
3. For borrow materials, perform a mechanical analysis, AASHO T88; and moisture-density curve, AASHO T180 or ASTM D1557.

1.3 SUBMITTALS

A. Test Reports: Submit two (2) copies of the following reports to the Architect/Engineer:

1. Report and certifications of granular fill.
2. Test reports on borrow material.
3. Field density test reports.
4. One (1) optimum moisture-maximum density curve for each type of soil encountered.
5. Other tests and material certificates, as required.

1.4 JOB CONDITIONS

A. Site Information: The data on subsurface conditions shall be as interpreted in the General Conditions. Additional test borings and other exploratory operations may be made at no cost to the Owner.

B. Existing Utilities:

1. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damage utilities to the satisfaction of the utility owner.
3. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.
4. Demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.

C. Use of explosives is not permitted.

D. Protection:

1. Protect structures, utilities, sidewalks, pavements and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Backfill and Fill Materials: Satisfactory soil materials for backfill and fill, free of rock or gravel larger than 1" in any dimension, debris, waste, vegetation, and other deleterious material shall be free, clean-draining sand, with a maximum of 10 percent passing the No.200 mesh,

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which building excavation and fill is to be performed and do not proceed with the work until satisfactory conditions have been corrected.

3.2 EXCAVATION

A. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations. See the drawing for additional excavation requirements.

B. Earth excavation includes the removal and disposal of pavement and other obstructions visible on the ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as unauthorized excavation.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or side dimensions without the specific direction of the Architect/Engineer. Unauthorized excavation, as well as remedial work shall be at the Contractor's expense.

D. Additional Excavation:

1. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material, after inspection by the Architect/Engineer.
2. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in the work.

E. Stability of Excavation:

1. Slope the sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
2. Shoring and Bracing: Provide shoring and bracing to comply with local codes and authorities having jurisdiction.

F. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into the excavations and flooding the project site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water from excavations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from excavations.

G. Material Storage:

1. Stockpile excavated materials classified as satisfactory soil material where directed, until required for backfill or fill. Place grade and shape stockpiles for proper drainage.
2. Dispose of excess soil material and waste materials as herein specified.

H. Excavations for Structures:

1. Conform to the elevations and dimensions shown on the drawings, within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.
2. In excavating for footing and foundations, take care not to disturb the bottom of the excavation.

I. Excavation for Trenches:

1. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.

3.3 COMPACTION

A. General: Control soil compaction during construction for compliance with the percentage of density specified for each area classification. See the foundation plans for additional excavation and compaction requirements.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557.

1. All Areas: Compact top 12" of subgrade and each layer of backfill or fill material at 95% maximum dry density.
2. Foundation Bearing Level: Compact the top 12" of subgrade below foundation bearing level to minimum of 95% maximum dry density. Use walk-behind vibrating sled or plate with static weight of between 500 and 2,000 lbs.

3.4 BACKFILL AND FILL

A. General:

1. In all areas, use satisfactory excavated or borrow material that has been sampled, tested and approved by the soil testing agency.

B. Placement and Compaction:

1. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment and not more than 4" in loose depth for material compacted by hand-operated tampers.
2. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage moisture content of the soil material. Compact each layer to the required percentage of maximum dry density for each area classification.
3. Place backfill and fill materials evenly adjacent to structures, to the required elevations.

3.5 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction:

1. Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
2. Perform field density tests in accordance with ASTM D1556 (sand cone method) or ASTM D2167 (rubber balloon test), as applicable.
3. Footing Subgrade: For each strata of soil on which footings will be placed, conduct, at least one (1) test to verify the required densities. Make a total of eight (8) tests on footing subgrades at locations directed by the Architect/Engineer; in addition, make at least two (2) tests in the elevator pit mat foundation subgrade.
4. Building Slab Subgrade: Make at least one (1) field density test of the subgrade for every 2,500 square feet of building slab, but in no case less than three (3) tests. In each compacted fill layer, make one (1) field density test for every 2,500 square feet of overlaying building slab, but in no case less than three tests.
5. Foundation Wall Backfill: Take at least one (1) field density test for each 50 feet of continuous wall footings.

B. If, in the opinion of the Architect/Engineer, based on testing service reports and inspection, the subgrade or fills which have been placed are below the specified density, provide additional compaction and testing at no additional expense.

END OF SECTION 02220

SECTION 02230

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing shrubs and vegetation to remain.
2. Removing shrubs and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees, shrubs and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Section "Project Record Documents."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

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

B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 LANDSCAPE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees and shrubs or around perimeter drip line of groups of trees and shrubs to remain. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within drip line of remaining trees and shrubs.
2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Replace trees and shrubs that cannot be repaired and restored to full-growth status.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.

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

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within drip line of remaining trees.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.

2. Excavating and backfilling for buildings and structures.

3. Subgrade course for concrete walks and pavements.

4. Base course for asphalt paving.

5. Excavating and backfilling trenches within building lines.

6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls."

2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subgrade course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

I. Stabilized Subgrade: Layer placed between the natural ground and base course for paving. Stabilized subgrade shall be FDOT Type B.

J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.

2. Drainage fabric.

3. Separation fabric.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Stabilized Subgrade: Stabilized subgrade per FDOT Standard Specifications for Type B.

F. Base: Limerock per FDOT Standard Specifications.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.

2. Tear Strength: 40 lbf (178 N); ASTM D 4533.

3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.

4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.

5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

C. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.

2. Tear Strength: 75 lbf (333 N); ASTM D 4533.

3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.

4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.

5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations from 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches (300 mm) on each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.

3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 APPROVAL OF SUBGRADE

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum density according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 98 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 98 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).

2. Walks: Plus or minus 1 inch (25 mm).

3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

A. Drainage Piping: Drainage pipe is specified in Division 2 Section "Foundation Drainage Systems."

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 6-inch (150-mm) course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches (300 mm) of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet (30 m) or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet (46 m) or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02361

TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following: Soil treatment with termiticide.

1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

1.4 SUBMITTALS

A. Product Data: For termiticide, include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application

2. Moisture content of soil before application

3. Brand name and manufacturer of termiticide

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes and rates of application used.

6. Areas of application

7. Water source for application

E. Warranty: Special warranty specified in this section

F. Certificate of Compliance: The licensed pest control company shall issue a Certificate of Compliance to the authorities having jurisdiction stating the following: The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label. Product listed as registered for use as a preventative treatment for termites for new construction by the Florida Department of Agriculture under authority of Chapter 487, Florida Statutes.

B. Source Limitations: Obtain termite control products through one source.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation. Warranty Period: 1 year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions and terms for agreement period and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor

b. Bayer Corporation; Premise 75

c. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

2.2 NOTICE OF TERMITE PROTECTION

A. Provide a permanent sign which identifies the termite treatment provider and need for reinspection and treatment contract renewal shall be provided. The sign shall be posted near the water heater or electrical panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. The licensed pest control service shall be Massey Services Pest Control, 2000 Wells Road, Orange Park, FL 32073 Tel: 904-272-1300. Massey Services Pest Control is currently the licensed pest control company for the Orange Park Campus.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a

continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along with both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 03010

CONCRETE, GENERAL

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 DESCRIPTION

A. All poured-in-place concrete work shown on the drawings is governed by this section. Concrete strength, not otherwise designated, shall be 3000 psi, as determined by the use of ASTM C31 and C39. All precast concrete shall be 3500 psi.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the latest editions of the following codes, specifications and standards, except as otherwise shown or specified. Where provisions of these codes and standards are in conflict with the building codes in force for this project, the building code shall govern.

1. ACI 301 "Specifications for Structural Concrete for Buildings".
2. ACI 318 "Building Code Requirements for Reinforced Concrete".
3. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
4. ACI 311 "Recommended Practice for Concrete Inspection".
5. ACI 347 "Recommended Practice for Concrete Formwork".
6. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".

B. Workmanship: The Contractor is responsible for correction of concrete work which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as directed by the Architect-Engineer. Should cylinders and cores indicate unacceptable concrete, load testing or removal and replacement of the concrete may be required at no cost to the Owner.

C. Concrete Testing Service:

1. The Contractor shall employ, at his own expense, a testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests, to design concrete mixes, and to perform strength tests associated with form removal. Testing agency shall meet the requirements of ASTM C1077 and ASTM E329.
2. The Contractor shall employ at his own expense, an independent testing laboratory to perform the testing of the concrete during the process of the work. Allow free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense. The independent testing agency shall be qualified according to ASTM C1077 and ASTM E329.

D. Welding of reinforcing steel shall be limited to welders whose competency has been treated according to standards of Structural Welding Code of American Welding Society.

1.4 DEFINITIONS

A. Cementitious Materials: Portland Cement alone or in combination with one or more of the following: fly ash, other pozzolans, ground granulated blast-furnace slag and silica fume; subject to compliance with requirements.

1.5 SUBMITTALS

A. Shop Drawings-Concrete Reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI Manual 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of reinforcement. Show location of construction joints planned.

B. Product Data: Submit manufacturer's product data, specifications with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, joint systems, curing compounds, waterstops, chemical floor hardeners, and others as requested by the Architect/Engineer.

C. Test reports specified in Paragraphs PROPORTIONING AND DESIGN OF MIXES, FIELD QUALITY CONTROL, and EVALUATION OF QUALITY CONTROL TESTS.

PART 2-PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete:

1. Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

B. Use overlaid plywood complying with U.S. Product Standards PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.

C. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

D. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2-edges and one side for tight fit.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces to be cured with water or curing compound.

2.2 REINFORCING MATERIALS

A. Reinforcing Bar: ASTM A615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A185, welded steel wire fabric, plain, fabricated from as-drawn steel wire into flat sheets.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI “Manual of Standard Practice”, unless otherwise indicated. Wood, brick and other devices will not be acceptable.

D. Slab-On-Grade: Use supports or horizontal runners where wetted base material will not support chair legs.

E. Exposed-To-View Concrete Surfaces: Where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized or plastic protected or stainless steel protected.

F. Fabricate steel reinforcing in accordance with CRSI’s “Manual of Standard Practice”.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials of the same brand and source, throughout the project.

1. Portland Cement. ASTM C150, as follows:

a. Provide Type I cement, except as otherwise indicated.
b. Provide Type III cement for High-Early Strength concrete where shown or scheduled.

c. Use one brand of cement throughout the project, unless otherwise accepted by the Architect/Engineer.

2. Fly Ash: ASTM C618, Class F.
3. Ground, Granulated Blast-Furnace/Slag: ASTM C989, Grade 100 or 120.

a. All concrete other than foundation concrete shall be a blend of Portland Cement and a minimum of 40% blast-furnace slag.

B. Aggregates:

1. General: Maximum aggregate size shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars. Provide aggregates from one source of supply to ensure uniformity in color, size and shape.
2. Normal Weight Aggregates: ASTM C33, and as herein specified. Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Architect/Engineer.

a. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.

b. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows (maximum aggregate size 1-1/2"):

1. Crushed stone, processed from natural rock or stone.
2. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.
3. Pea Gravel Aggregate: Conform to ASTM C404, Size No.8.
4. Lightweight Aggregates: ASTM C330.

C. Water. Clean, fresh, drinkable.

D. Admixtures: Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in accepted mixes, unless otherwise authorized in writing by the Architect/Engineer.

1. Air-Entraining Admixture: ASTM C260.
2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1% chloride ions.
3. Set-Control Admixture. ASTM C494, as follows:

a. Type D, Water-reducing and Retarding with not more than 0.1% chloride ions.
b. Type E, Water-reducing and Accelerating with not more than 0.1% chloride ions.

4. Fly Ash: ASTM C618, Class F.
5. Calcium Chloride: Do not use calcium Chloride in concrete.

2.4 RELATED MATERIALS

A. Performed Expansion Joint Fillers: Fiber type conforming to ASTM D1751 or Cork, ASTM D1752, Type II.

B. Joint Sealing Compound:

1. Horizontal surfaces (maximum 3% slope).
a. Inside building - ASTM D1190 or ASTM D1850; outside building - ASTM D1190.

C. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.

D. Curing Materials:

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yard,

complying with AASHTO M182, Class 3.

2. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
   a. Waterproof paper.
   b. Polyethylene film.
   c. Polyethylene-coated burlap.
3. Membrane-Forming Curing Compound: ASTM C309, Type I.

E. Non-Shrink Grout: Conform to CRD-C621, factory pre-mixed grout; use non-metallic, "Masterflow 713" by Master Builders; "Sonogrout," by Sonnoborn-Contech, or equal.

F. Vapor Barrier: ASTM D4397 polyethylene sheeting, minimum 6 mil. thickness.

G. Epoxy Adhesive: ASTM C881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

1. Products. Subject to compliance with requirements, provide one of the following:

"Epoxtite"; A.C. Horn.
"Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
"Sikadur 35, Hi-Med, LV"; Sika Chemical Corp.
"Euco Epoxy 463 or 615"; Euclid Chemical Co.
"Patch and Bond Epoxy"; The Burke Co.
"Sure-Poxy"; Kaufman Products Inc.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. General:

1. All concrete shall contain a minimum of 5-sacks of cement per cubic yard. Tremie concrete, where required; use minimum of 7-sacks of cement per cubic yard.
2. All concrete not specifically designated shall be proportioned for a strength of 3,000 lbs. per square inch at 28 days of age.

B. Slump Limits:

	Slump in Inches	
Type of Construction	Maximum	Minimum
Reinforced foundation walls and footings	5	2
Slabs and beams	5	3
Reinforced columns and pilasters	5	3
Masonry Grout	10	8

C. Proportion design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1 for normal weight concrete and ACI 211.2 for structural lightweight concrete.

1. Field Experience Method: When field experience method is used to select concrete proportions, establish procedures as specified in ACI 301 and ACI 318. When proportioning by field experience method furnish mix design and independent testing facility proof of standard deviation using materials, mix and production facility proposed.
2. Laboratory Trial Method: When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C192 and conduct strength test in accordance with ASTM C39, as specified in ACI 301.
   a. When proportioning by the trial batch method, furnish compressive strength developed at 7-days and 28-days, from not less than 2 test cylinders cast for each 7- and 28-day test, and for each design mix.

   b. Establish a curve showing relationship between water-cement ratio (or cement content) and

compressive strength, with at least 3 points representing batches which produce strengths above and below that required. Use not less than 2 specimens tested at 28-days, or an earlier age when acceptable to the Architect/Engineer, to establish each point on the curve.

D. Submit Testing Service reports to the Architect/Engineer of each proposed mix for each type of concrete at least 15 days prior to start of work. Do not begin concrete production until mix data have been reviewed by the Architect/Engineer.

E. Admixtures:

1. Use air-entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having 4-1/2 percent entrained air with tolerance in either direction from this optimum of 1-1/2 percent.
2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
3. Contractor may use fly ash as part of the cement content of the foundation concrete; fly ash shall be a maximum of 25 percent of the cement content (cement and fly ash). All other concrete shall have a cement content of a blend of Portland Cement and a maximum of 50 percent of the cement content of blast-furnace slag.

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of material, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Architect-Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Architect/Engineer before using in the work.

PART 3-EXECUTION

3.1 FORMS

A. Design of formwork for structural stability and sufficiency is the Contractor's responsibility. Conform to ACI 301, within tolerance limits of ACI 117.

B. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, and recesses to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges 3/4 inches, unless otherwise noted, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Form Ties: Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.
2. Unless otherwise shown, provide form ties which will not leave holes larger than 1" diameter in concrete

surface.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute's “Manual of Standard Practice”, for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than 2" beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

F. Splices: Provide standard reinforcing splices by lapping ends per ACI 318, 2005 Edition.

3.3 JOINTS

A. Construction Joints: Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the Architect/Engineer.

B. Provide keyways at least 1-1/2" deep in all construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints unless shown or noted otherwise.

D. Controls Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4" wide by 1/5 to 1/4 of the slab depth, unless otherwise shown. Form control joints by inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove and loose debris. Fill with joint sealant material continuous. Sawn joints are not permitted.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

3.5 PREPARATION OF FORM SURFACES

A. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE MIXING

A. Ready-Mix Concrete: All concrete shall be ready-mix concrete. Comply with the requirements of ASTM C94, and herein specified.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85 degrees F and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F, reduced the mixing and delivery time to 60 minutes.
2. No additional water shall be added to concrete without the approval of the Architect/Engineer. Should additional water be required to obtain a slump as specified in this section for the type of concrete, the Contractor shall perform slump tests in accordance with ASTM C143 to determine the actual slump of the concrete in the mixer. The Contractor may then add water, but in no case shall the additional water exceed 3 percent of the mix-design water content, nor shall the slump of the mix exceed the maximum slump specified for the type concrete. Slump tests and the addition of water to the mixer shall be completed within 15 minutes if the arrival of the mixer at the site. Additional water shall not be added to the mix after the mixer has been on the site longer than 15 minutes.
3. A delivery ticket showing truck number, date, and time that mixing was started shall be given to the Contractor's superintendent at the job site before placing the concrete from the truck mixer. At the job site the Contractor's superintendent shall note on the delivery ticket the time of completion of the concrete placement from the truck and the general area of the structure in which the concrete was placed. A complete file of all delivery tickets shall be maintained and kept available at the job site until completion of the project.

3.7 CONCRETE PLACEMENT

A. General: Comply with ACI 304, and as herein specified.

B. Pre-placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Thoroughly wet wood forms immediately before placing concrete where form coatings are not used. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Maintain reinforcing in the proper position during concrete placement operation.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions.

1. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed later of concrete and at least 6" into the preceding layer. At each insertion

limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

G. Bring slab surfaces to the correct level with a straightedge and strikeoff. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

H. Do not place concrete in an inundated excavation.

I. Cold Weather Placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI306 and as herein specified. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of 50 degrees F and not more than 80 degrees F at point of placement.
2. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

J. Hot Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees f at timeof placement. Chilled mixing water or chopped ice may be used to lower temperature provided water equvalent of ice is to total amount of mixing water.
2. Fog-spray forms, steel reinforcing and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots or dry areas.

3.8 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

3.9 FINISHING FLOORS AND SLABS

A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified.

1. After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth surface

defects which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors exposed to view and where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3-coats: first coat, 1/3-strength. Evenly apply each coat, and allow 24 hours for drying between coats.

1. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.
2. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place, unless otherwise indicated. Mix, place and cure concrete, as specified to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations: Provide pre-engineered building column bases and foundations as shown on Drawings. Set anchor bolts for building columns at correct elevations, complying with diagrams and templates from manufacturer furnishing pre-engineered metal buildings.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h (1kg/sq. m x h) before and during finishing operations. Apply according to manufacturer’s written instructions after placing, screeding and bull floating or darbying concrete, but before float finishing.

C. Uniformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven (7) days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 inch (300 mm) lap over adjacent absorptive covers.

2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Cure concrete surfaces to receive floor coverings with either a moisture retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. Removal: after curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer, unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of floor slab and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection are maintained.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

C. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

D. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 JOINT FILLING

A. Prepare, clean and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Contractor shall employ a testing laboratory approved by Architect/Engineer to perform other tests and to submit test reports. Sampling and testing for quality control during placement of concrete shall include the following, as directed by Architect.

B. Sampling Fresh Concrete. ASTM C172, except modified for slump to comply with ASTM C94.

1. Slump. ASTM C143; one test for each concrete load at point of discharge; and one test for each set of compressive strength test specimens.
2. Concrete Temperature ASTM C1064. Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens made.
3. Compression Test Specimen. ASTM C31; one set of 4-standard cylinders for each compressive strength, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
4. Compressive Strength Test. ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 2,500 sq. ft. of surface area placed; 1-specimen tested at 7-days; 2-specimens tested at 28 days.
   a. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
   b. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.

C. Test results will be reported in writing to Architect and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03351

POLISHED CONCRETE FINISHING
(Bid Alternate No. 5)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: This Section specifies dyed and polished concrete.

B. Related Sections:

1. Section 03010 Concrete, General

2. Section 07920 Joint Sealants

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 302.1R Guide for Concrete Floor and Slab Construction.

B. ASTM International:

1. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

2. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.

3. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

C. National Floor Safety Institute (NFSI):

1. NFSI Test Method 101-A Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:

1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.

2. Reflectivity: Increase of 35% as determined by standard gloss meter.

3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.

4. High Traction Rating: NFSI 101-A, non-slip properties.

B. Design Requirements:

1. Hardened Concrete Properties:

a. Minimum Concrete Compressive Strength: 3500 psi (24 MPa).

b. Normal Weight Concrete: No lightweight aggregate.

c. Non-air entrained.

2. Placement Properties:

a. Natural concrete slump of 4 1/2 inches - 5 inches (114 - 127 mm). Admixtures may be used.

b. Flatness Requirements:

i. Overall FF 40.

ii. Local FF 20.

3. Hard-Steel Troweled (3 passes) Concrete: No burn marks. Finish to ACI 302.1R, Class 5 floor.

a. Class 6 floors, special colored mineral aggregate hardener with repeated hard steel trowel finish.

4. Curing Options:

a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure)

i. Acrylic curing and sealing compounds not recommended.

b. Sheet membrane (ASTM C171); polyethylene film not recommended.

c. Damp Curing: Seven day cure.

1.4 ACTION SUBMITTALS

A. General: Submit listed action submittals in accordance with Contract Conditions and Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate information on shop drawings as follows:

1. Typical layout including dimensions and floor grinding schedule.

2. Plan view of floor and joint pattern layout.

3. Areas to receive colored surface treatment.

4. Hardener, sealer, densifier in notes.

C. Product Data: Submit product data, including manufacturer's SPEC-DATA® product sheet, for specified products.

1. Material Safety Data Sheets (MSDS).

2. Preparation and concrete grinding procedures.

3. Colored Concrete Surface, Dye Selection Guides.

1.5 INFORMATION SUBMITTALS

A. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in 1.03 Performance Requirements.

2. Certificates:

a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

b. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.

c. Current contractor's certificate signed by manufacturer declaring contractor as an approved installer of polishing system.

3. Manufacturer's Instructions: Manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

A. Warranty: Submit warranty documents specified.

B. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Section 01782 Operations and Maintenance data.

1. Include:

a. Manufacturer's instructions on maintenance renewal of applied treatments.

b. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

2. Installer trained and holding current certification for polished concrete finish installation.

3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Regulatory Requirements.

1. NFSI Test Method 101-A Phase Two Level High Traction Material.

C. Mock-Ups:

1. Construct mock-ups in accordance with Section 01400 Quality Requirements.

2. Mock-Up Size: 100 sq. ft. sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.

3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.

4. Allow 24 hours for inspection of mock-up before proceeding with work.

5. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

D. Preinstallation Meetings: Conduct a preinstallation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Review the following:

1. Environmental requirements.

2. Scheduling and phasing of work.

3. Coordinating with other work and personnel.

4. Protection of adjacent surfaces.

5. Surface preparation.

6. Repair of defects and defective work prior to installation.

7. Cleaning.

8. Installation of polished floor finishes.

9. Application of liquid hardener, densifier.

10. Protection of finished surfaces after installation.

1.8 DELIVERY, STORAGE & HANDLING

A. General: Comply with Section 01600 Product Requirements.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery:

1. Deliver materials in manufacturer's original packaging with identification labels and seals intact.

D. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

2. Protect concrete slab.

a. Protect from petroleum stains during construction.

b. Diaper hydraulic power equipment.

c. Restrict vehicular parking.

d. Restrict use of pipe cutting machinery.

e. Restrict placement of reinforcing steel on slab.

f. Restrict use of acids or acidic detergents on slab.

E. Waste Management and Disposal:

1. Separate waste materials for reuse and recycling.

2. Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.9 PROJECT AMBIENT CONDITIONS

A. Installation Location: Comply with manufacturer's written recommendations.

1.10 SEQUENCING

A. Sequence With Other Work: Comply with manufacturer's written recommendations for sequencing construction operations.

1.11 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

C. Warranty: Commencing on date of project's substantial completion.

1.12 MAINTENANCE

A. Comply with manufacturer's written instructions to maintain installed product.

1.13 EXTRA MATERIALS

A. General Contractor to provide maintenance materials in accordance with Section 01770, Closeout Procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ensure manufacturer has minimum five (5) years experience in manufacturing components similar to or exceeding requirements of project.

2.2 POLISHED CONCRETE FINISHING PRODUCTS

A. Manufacturer: L & M Construction Chemicals, Inc., or approved equal.

1. Contact: 14851 Calhoun Rd., Omaha, NE 68152-1140; Telephone: (800) 362-3331, (402) 453-6600; Fax: (402) 453-0244; E-mail: info@lmcc.com; website: www.lmcc.com, www.fgs-permashine.com.

2. Approved Equal: Retroplate Concrete Polishing Systems by Advanced Floor Products

B. Proprietary Products/Systems: (or approved equal products/systems).

1. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.

a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Hardener Plus.

2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.

a. Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 750.

3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.

a. Acceptable Material: L & M Construction Chemicals, Inc., Petrotex.

4. Concrete Dyes: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.

a. Acceptable Material: L & M Construction Chemicals, Inc., Vivid Concrete Dyes.

5. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).

a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Concrete Conditioner.

6. Finish: Standard [High gloss (HG-1), 1500 grit].

7. Color: Two colors will be selected.

2.3 SOURCE QUALITY CONTROL

A. Ensure concrete finishing components and materials are from single manufacturer.

2.4 PRODUCT SUBSTITUTIONS

A. Substitutions: In accordance with Section 01250 Contract Modification Procedures.

PART 3 EXECUTION

3.1 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturers specification data sheets.

B. Use only manufacturer's certified installers.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

B. Verify Concrete Slab Performance Requirements:

1. Verify concrete is cured to 28 day and 3500 psi strength.

2. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.

3.3 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

C. Remove all surface contamination.

3.4 INSTALLATION

A. Floor Surface Polishing and Treatment:

1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.

2. Apply floor finish prior to installation of fixtures and accessories.

3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method.

a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.

b. Expose aggregate in concrete surface only as determined by approved mock-up.

c. All concrete surfaces shall be as uniform in appearance as possible.

4. Dyed and Polished Concrete.

a. Locate demarcation line between dyed surfaces and other finishes.

b. Polish concrete to final finish level.

c. Apply diluted dyes to polished concrete surface.

d. Allow dye to dry.

e. Remove residue with dry buffer; reapply as necessary for desired result.

5. Apply FGS Hardener Plus, Hardener, Densifier As Follows:

a. First coat at 250 ft2/gal (6.25 m2/L).

b. Second coat at 350 ft2/gal (8.75 m2/L).

c. Follow manufacturer's recommendations for drying time between successive coats.

6. Remove defects and repolish defective areas.

7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.5 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.6 FINAL CLEANING

A. Cleanup in accordance with Section 01524 Construction Waste Management.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

3.7 PROTECTION

A. Protect installed product from damage during construction.

B. Protect with EZ Cover™ by McTech Corp., or comparable product.

1. Contact: Phone: (866) 913-8363; website: www.ezform.net.

END OF SECTION

SECTION 03450

ARCHITECTURAL PRECAST CONCRETE - PLANT CAST
(Bid Alternate No. 4)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section refers to architectural precast concrete column units.

B. Architectural precast concrete includes the following:

1. Precast concrete units as defined in the architectural plans. Includes columns or any other decorative element designed to be cast out of concrete.

2. These are non-structural, self supporting units.

1.2 SUBMITTALS

A. Product data and instructions for manufactured materials and products.

B. Shop drawings prepared showing complete information concerning the precast concrete units. Indicate member dimensions and side view. Unless otherwise noted, anchors will be embedded in a standard configuration.

C. Samples - Submit samples of color options and texture options for selection process.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabricator shall have a minimum of 10 years successful experience in fabrication of architectural precast concrete units. Fabricator shall have sufficient production capacity to produce, transport and deliver required units without causing delay in the project.

B. Design modifications will be made only as necessary to meet field conditions and to ensure proper fitting of the work and only as acceptable to the Architect. Maintain general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown without architects approval.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Schedules and priorities will be based on the information provided by the customer. Products to be packaged to protect the finish during transport. Precast may be a long lead time item and shall be scheduled accordingly.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Reinforcing shall be provided as required to ensure safe handling.

B. Corrugated Wall Ties - Included in moldings as the mechanical fastener. 22 gauge mill galvanized steel - 7/8" x 7".

C. Premium grade construction adhesives shall be used for bonding columns where latex mortar cannot be used.

2.2 CONCRETE MATERIALS

A. Portland Cement: Type 1 Portland Cement Lehigh White.

B. Use only one brand, type and source of supply of cement throughout the project.

C. Coarse/Fine Aggregate - Sand and Gravel: Hard, durable, selected and graded; free of material that causes staining or reacting with cement.

D. Pigments: Nonfading, resistant to lime and other alkalis.

E. Water: Drinkable, free from foreign materials in amounts harmful to concrete and embedded steel.

F. Air-Entraining Admixture: Utilize standard mix designs incorporating admixtures which facilitate the workability, curing and strength of the mix.

G. Compressive Strength: 3500-5000 psi minimum at 28 days.

2.3 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and following dimensional tolerances, unless otherwise indicated.

B. Molds: Accurately construct molds mortar-tight and of sufficient strength to withstand pressures due to concrete placing operations and temperature changes. Maintain mold work to provide completed precast concrete units of shapes, lines and dimensions indicated, within specified fabrication tolerances.

C. Dimensional Tolerances of Finished Units: Ornamental architectural precast concrete, being tapered by design, is measured for length, width and thickness at the surface from which the mold is loaded maintaining plus or minus 1/16 of an inch tolerance. Overall height and width measured at face adjacent to mold at time of casting:

D. Surface Finish: Fabricate precast units and provide exposed surface finished as follows:

1. Traditional – smooth, relatively void free texture

PART 3 - EXECUTION

A. The installation requires experienced, knowledgeable installers in order to achieve a quality installation. Considerations for installation include:

1. Install precast concrete members plumb, level and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.

2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

3. Accessories: Install clips, hangers and other accessories required for erection of precast units to supporting members and backup materials.

4. Anchor units in final position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges and spacers as soon as possible after anchoring and grouting are completed.

5. Cleaning: Clean exposed facings to remove dirt and stains on units after erection and completion of joint treatments. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes that could change the character of exposed concrete finishes.

END OF SECTION

SECTION 04200

UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Concrete unit masonry
2. Brick masonry

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Steel lintels in unit masonry are specified in Division 5 Section "Metal Fabrications".
2. Hollow metal frames in unit masonry are specified in Division 8 Section "Hollow Metal Doors and Frames".

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

B. For Concrete Unit Masonry: As follows, based on net area:

1. f'm = 1900 psi

C. For brick unit masonry: as follows based on gross area:

1. f'm = 2000 psi

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of Contract and Division 1 Specifications.

B. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270
2. Grout mixes
3. Masonry units

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the work.

B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other characteristics can be maintained and contamination avoided.

D. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

C. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100° F.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows for each type of concrete masonry unit required.

B. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

C. Provide square-edged units for exterior corners and bullnose edges on exposed interior corners.

D. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below;

E. Do not use chipped or broken units.

F. Not less than the unit compressive strengths required to produce concrete unit masonry construction of the strength indicated.

1. Weight Classification: Normal weight.
2. Aggregates: Do not use aggregates made from pumice, scoria or tuff.
3. Provide Type II, non-moisture-controlled units.

4. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on the Drawings:

   a. 4" nominal: 3-5/8" actual
   b. 6" nominal: 5-5/8" actual
   c. 8" nominal: 7-5/8" actual
   d. 12" nominal: 11-5/8" actual

G. Exposed Faces: Smooth uniform texture and free from chips and broken edges.

H. Provide ¾" clearance at all structural steel components by laying or cutting of units.

I. Provide 2 hour fire rated concrete masonry units as required.

2.2 BRICK MASONRY

A. General: Provide shapes indicated for each form of brick masonry required.

B. Face Brick: ASTM C 216:

1. Initial Rate of Absorption: Between 5 and 20 g/30 sq. in. per minute when tested per ASTM C 67.

2. Surface Coloring: Brick with surface coloring, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet. Face brick color and texture shall match the existing face brick

3. Type: FBS

4. Size: Brick manufactured to the following actual dimensions within tolerances specified in ASTM C 216:

   a. Size of existing units: 3 ⅛ " wide by 2 $^{13}/_{16}$" high by 9⅝" long. Brick size shall match existing building (FIELD VERIFY).

5. Products: Subject to compliance with requirements, base bid shall be based upon the following. Face bricks shall match the existing face bricks of the existing buildings. (FIELD VERIFY).

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II

B. Masonry Cement: ASTM C 91.

C. Mortar Cement: UBC Standard No. 21-14

D. Hydrated Lime: ASTM C 207, Type S.

E. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.

F. Aggregate for Mortar: ASTM C 144

G. Aggregate for Grout: ASTM C 404

H. Water: Clean and potable.

I. Brickwork mortar color shall match existing.

2.4 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615

2. Grade 60

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

2.5 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following:

B. Galvanized carbon steel wire, coating class as follows:

C. ASTM A 153, Class B-2 for both interior and exterior walls.

D. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

1. Wire Diameter for Side Rods: 9 gage
2. Wire Diameter for Cross Rods: 9 gage

E. For single & double wythe masonry, provide type with deformed side rods and smooth cross rods and a unit width of 1½" to 2 " less than the wall thickness.

1. Ladder design with perpendicular cross rods spaced not more than 16” o.c. Diagonal design with cross rods is not approved.

2.6 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. Wire: As follows:

1. Galvanized Carbon Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
2. Wire Diameter: 0.1875 inch

C. Steel Sheet: As follows:

1. Thickness of Steel Sheet Galvanized After Fabrication: Uncoated thickness of steel sheet for hot-dip galvanizing after fabrication.
2. Steel Plates and Bars: ASTM A 36, hot-dip galvanized to comply with ASTM A 153, Class B-1, B-2 or B-3, as applicable to size and form indicated.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STRUCTURAL FRAME

A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it.

1. Wire Diameter: 0.1875”.

2.8 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers; of diameter and length indicated and in the following configurations:

1. Headed bolts

2.9 EMBEDDED FLASHING MATERIALS

A. Vinyl Sheet Flashing: Flexible sheet flashing especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color, and of thickness indicated below:

1. Thickness: 30 mils
2. Application: Use where flashing is fully concealed in masonry.

B. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:

1. Vinyl Sheet Flashing:

a. Lexusco Water Barrier, International Permalite, Inc.
b. Nervastral, Nervastral, Inc.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

B. Plastic Weep Hole/Vent:

1. Available Products: Subject to compliance with requirements, weep hole/ventilators that may be incorporated into the work include, but are not limited to, the following:

a. Cell Vent, Dur-O-Wall, Inc.

2.11 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of ½ cup dry measure tetrasodium polyphosphate and ½ cup dry measure laundry detergent dissolved in 1 gallon of water.

2.12 MORTAR AND GROUT MIXERS

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

B. Do not use calcium chloride in mortar or grout.

C. Mortar for Unit Masonry: Comply with ASTM C 270, proportion specification for types of mortar indicated below:

1. Type S

D. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated, or if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry. Do not proceed until satisfactory conditions have been corrected.

B. For the record, prepare written report, endorsed by the Installer, listing conditions detrimental to the performance of unit masonry.

C. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.

B. Build chases and recesses as shown or required to accommodate items specified in this and other sections of the Specifications.

C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arises, do not exceed ¼ inch in 10 feet, nor 3/8 inch in 20 feet, nor ½ inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed ¼ inch in 20 feet, nor ½ inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus ¼ inch in 10 feet, nor ½ inch maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed ¼ inch in 20 feet, nor ½ inch in 40 feet or more. For top surface of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 inch within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed ½ inch in 20 feet, nor ¾ inch in 40 feet or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus ¼ inch nor plus ½ inch.

E. Variation in Mortar Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to ½ inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness by more than plus or minus 1/8 inch. Do not vary from head-joint thickness from adjacent head-joint thickness by more than 1/8 inch. Do not vary from collar-joint thickness indicated by more than minus ¼ inch or plus 3/8 inch. Brick mortar joints shall match the thickness of the existing brick mortar joints.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half size units at corners, jambs, and where possible, at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

A. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

B. Stopping and Resuming Work: In each course, rack back half-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

C. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

D. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated. Conduit and pipes shall not run horizontally through masonry.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8 inch joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 STRUCTURAL BONDING OF MASONRY

A. Corners: Provide interlocking masonry unit bond in each course, at corners, unless otherwise shown.

B. Provide continuity with horizontal joint reinforcement at corners by using prefabricated "L" units in addition to masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties not more than 16" o.c.
2. Provide continuity with horizontal-joint reinforcement by using pre-fabricated "T"- units.

3.7 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush.

B. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

C. Tie exterior wythe to back-up with individual metal ties. Stagger alternate courses.

3.8 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8" in exterior side of walls, ½" elsewhere. Lap reinforcing a minimum of 6".

B. Space reinforcement not more than 16 inches o.c.

C. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 24 inches beyond opening.

D. Reinforcement above is in addition to continuous reinforcement.

E. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

F. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1" in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but nor more than 24" o.c. vertically and 36" o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.

C. Build-in horizontal pressure relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible air filler of width required for installing a sealant and backer rod specified in Division 7 Section "Joint Sealants".

3.11 LINTELS

A. Provide masonry lintels where shown and where openings of more than 24 inches for block size units are shown without structural steel or other supporting lintels.

B. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcement bars indicated or required to support loads indicated. Cure precast lintels by same method as CMU.

C. Provide galvanized steel lintel angles at brick openings.

D. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as required to support reinforced masonry elements during construction.

B. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete. Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

C. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

D. Grouting: Do not place grout until entire height of masonry to be grouted has attained a sufficient strength to resist grout pressure.

E. Do not exceed the following pour heights for grout:

1. For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.

2. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.

3. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.

4. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.

F. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height.

G. Provide cleanout holes at each vertical reinforcing bar.

3.13 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corner, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry.

E. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

F. Test cleaning methods on sample wall panel; leave half panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of masonry.

G. Protect adjacent stone and non-masonry surfaces from contract with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

H. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

I. Clean brick by means of bucket and brush hand-cleaning method described in BIA “Technical Note No. 20 Revised” using the following masonry cleaner:

1. Job mixed detergent solution.

J. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.

K. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL FRAMING

PART I GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Structural steel.
2. Prefabricated building columns.
3. Grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, “Code of Standard Practice for Steel Buildings and Bridges.”

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components. Furnish shop drawings for approval. Fabrication before approval of shop drawings will be at Contractor’s risk.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify demand critical welds.

C. Qualification Data: For qualified testing agency.

D. Welding Certificates, if requested by the Architect/Engineer.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Mill test reports for structural steel, including chemical and physical properties, if requested by the Architect/Engineer.

G. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

1.5 QUALITY ASSURANCE

A. The following codes and publications, of the latest edition, govern this work unless indicated or specified otherwise.

1. American Institute of Steel Construction (AISC): Comply with the following, except when modified herein:
   a. Code of Standard Practice for Steel Buildings and Bridges.
   b. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
   c. Specification for Structural Joints using ASTM A325 or A490 Bolts.
2. American Welding Society (AWS); Comply with the following, except when modified herein:
   a. AWS D1.1, Structural Welding Code.
3. Steel Structures Painting Council (SSPC): Comply with the following, except when modified herein:
   a. Surface Preparation Specifications. (References appear as the specification number preceded by the initials SSPC).
4. American Society for Testing and Materials (ASTM): Comply with the ASTM standards herein.

B. Certification of Welders: Welding of all structural steel shall be limited to welding operators whose competency has been tested in accordance with the Structural Welding Code of AWS.

C. Testing: An independent testing laboratory shall be employed by the Contractor to certify that all fasteners and welds are installed in accordance with the drawing specifications. Upon completion of inspection and testing, submit two (2) copies of all reports to the Architect/Engineer. Bolted connections shall be tested in accordance with AISC specifications. Perform visual inspection of all welds.

D. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop [rimers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

PART 2 PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992; ASTM A572, Grade 50.

B. Channels, Angles: ASTM A36; ASTM A572, Grade 50.

C. Plate and Bar: ASTM A36; ASTM A572, Grade 50.

D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B structural tubing (Fb=46ksi).

E. Steel Pipe: ASTM A53, Type E or S, Grade B.

1. Weight Class: Standard, unless otherwise noted.
2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS AND ANCHORS

A. High-Strength Bolts, Nuts and Washers: ASTM A325, Type 1.

1. Direct-Tension Indicators: ASTM F959, Type 325 (ASTM F959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts and Washers: ASTM A490 (ASTM A490M), Type 1, heavy-hex steel structural bolts.

1. Direct-Tension Indicators: ASTM F959, Type 490, compressible-washer type with plain finish.

C. Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Headed Anchor Rods: ASTM F1554, Grade36, (ASTM F1554, Grade 55, weldable); ASTM A354; ASTM A448, straight.

1. Nuts: ASTM A563 hex carbon steel.
2. Plate Washers: ASTM A36 carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A153, Class C.

E. Threaded Rods: ASTM A36; A572, Grade 50.

1. Nuts: ASTM A563 heavy hex carbon steel.
2. Washers: ASTM A36, carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A153, Class C.

2.3 PRIMER

A. Primer: Comply with Division 09 Painting Sections.

B. Primer: SSPC-Paint Specification No.2; minimum thickness of coat shall be 2.0 mil., dry film thickness.

C. Galvanizing Repair Paint: MPI#18, MPI#19 or SSPC Paint 20.

2.4 GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, non corrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural steel assemblies, including welding of units, before starting shop priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC SP3, "Power Tool Cleaning".

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints" using ASTM A325 or A490 Bolts for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
2. All welds at exposed structural steel tube frames shall be ground smooth.

2.7 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP3, "Power Tool Cleaning".

C. Painting: Prepare steel and apply a one-coat, non asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems", to

provide a dry film thickness of not less than 2.0 mils, using SSPC-Paint No.2.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dipped process to structural steel according to ASTM A123, A153 or A386, as applicable.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

D. Welded Connections: Perform visual inspections of shop-welded connections.

E. All exposed welds shall be ground smooth.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces and other supports during erection to keep structural steel secure, plumb and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims or setting nuts, as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor will engage a qualified independent testing and inspecting agency to inspect field welds, and high-strength bolted connections. The testing agency will be acceptable to the Architect/Engineer.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP2 hand tool cleaning or SSPC-SP3 power tool cleaning.

C. Touch-up Painting: Cleaning and touch-up painting are specified in Division 09 painting Sections.

END OF SECTION 05120

SECTION 05310

STEEL DECKING

PART I 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 the following:

1. Roof deck.

B. Related Sections include the following:

1. Division 3 Section:"Concrete" for concrete fill.
2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding Certificates, if requested by the Architect/Engineer.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code-Sheet Steel".

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members".

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect steel deck from corrosion, deformation and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, include, but are not limited to, the following.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:

a. ASC Profiles, Inc.
b. Canam Steel Corp; The Canam Manac Group.
c. Consolidated Systems, Inc.
d. DACS, Inc.
e. D-Mac Industries, Inc.
f. Epic Metals Corporation.
g. Marlyn Steel Decks, Inc.
h. New Millennium Building Systems, LLC.
I. Nucor Corp; Vulcraft Division.
j. Roof Deck, Inc.
k. United Steel Deck, Inc.
l. Valley Joist; Division of EBSCO Industries, Inc.
m. Verco Manufacturing Co.
n. Wheeling Corrugating Company; Div. Of Wheeling-Pittsburg Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck", in SDI Publication No.30, and with the following:

1. Galvanized Steel Sheet: ASTM A653, Structural Steel (SS), Grade 33; G60 (Z180) zinc coating.
2. Deck Profile: See Structural Plans
3. Profile Depth: See Structural Plans
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 12 (4.8 mm) minimum diameter.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359 inch (0.91 mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Column Closures, End Closures, Z-Closures and Cover Plates: Steel sheet, of same material, finish and thickness as deck, unless otherwise indicated.

E. Weld Washers: Uncoated steel sheet, shaped to fit deck rib 0.0598 inch thick with factory-punched hole of 3/8 inch (9.5 mm) minimum diameter.

F. Galvanizing Repair Paint: ASTM A780.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No.30, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF DECK INSTALLATION

A. Fasten roof-deck panels to structural steel and steel joist supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38mm) long, and as follows:

1. Weld Diameter: 5/8 inch nominal.
2. Weld Spacing: See Structural Plans

B. Fasten Roof Deck to light gage metal framing members with screws as shown on the drawings.

C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of ½ of the span or 18 inches.

1. Mechanically fasten with self-drilling, No.10 (4.8 mm) diameter or larger, carbon-steel screws.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Visually inspect field welds.

C. Testing agency will report inspection results promptly in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck and galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05400

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 1 Specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior non load-bearing wall and miscellaneous framing.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design framing systems to provide for a movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature of 120F

2. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

3. Design replacement members to same size as original members. If greater strength is required, decrease spacing or provide heavier gauge members.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing – Header Design."

2. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing, fabrication, and fastening and anchorage details including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation (must be licensed in the State of Florida)

C. Welding Certificates

D. Qualification Data: For professional engineer.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Steel sheet.

2. Expansion anchors.

3. Power-actuated anchors

4. Mechanical fasteners

5. Vertical deflection clips

6. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For of cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Engage a Florida registered professional engineer to prepare design calculations, shop drawings, and other structural data.

B. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design and extent.

C. Product Tests: Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including base metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility and metallic coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Fire Test Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. AISI Specifications: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and it's "Standard for Cold-Formed Metal Framing – General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing – Header Design."

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings.

1.6 DELIVERY, STORAGE AND HANDLING

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

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Allied Studco
2. AllSteel Products, Inc.
3. Clark Steel Framing
4. Consolidated Fabricators Corp.; Building Products Division
5. Craco Metals Manufacturing, LLC
6. Custom Stud, Inc.
7. Dale/Incor
8. Dietrich Metal Framing; a Worhington Industries Company
9. The Formetal Co. Inc.
10. Innovative Steel Systems
11. SCAFCO Corp.
12. Southeastern Stud and Components, Inc.
13. Steel Construction Systems
14. Steeler, Inc.
15. Super Stud Building Products, Inc.
16. United Metal Products, Inc.

2.2 MATERIALS

A. 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: G90 or equivalent.

B. 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: G90

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Base Metal Thickness: 0.0566 inch

2. 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: 0.0566 inch

2. Flange Width: 2 inches.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

a. Dietrich Metal Framing; a Worthington Industries Company

b. MarinoWare, a division of Ware Industries

c. SCAFCO Corporation

d. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

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

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. Anchor clips

4. End clips

5. Gusset plates

6. Stud kickers, knee braces, and girts

7. Backer plates

2.5 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, headless, hooked bolts and carbon-steel nuts, and flat hardened-steel washers, zinc-coated by hot-dip process according ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to five times 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 capability to sustain, without failure, a load equal to ten times design load, as determined by testing per ASTM E 1190, conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS Standards

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, ASTM A 780.

2.7 FABRICATION

A. Fabricate cold-formed metal 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 recommendations, 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 metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 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 not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, 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 assemblies level, plumb, 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 cold-formed metal framing assembly to 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions" and to manufacturers written instructions unless more stringent requirements are indicated. Cold-formed metal framing may be shop or field fabricated for installation or it may be field assembled.

B. Install cold-formed metal framing and accessories plumb, square and true-to-line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding, bolting or screw fastening, as indicated on drawings. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 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 not less than three exposed screw threads.

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

D. Install temporary bracing and supports to secure framing and support loads comparable to 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.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation (specified in Division 7) 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.

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

H. Erection Tolerances: Install cold-formed metal 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 (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structures as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs at 16".

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on shop drawings but not more than 54 inches apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel; welded or mechanically fastened to webs of punched studs.

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

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field tests and inspections, and prepare test reports.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor expense, will be performed to determine compliance of corrected Work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair galvanized coatings on fabricated and installed cold-formed metal 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 cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for countertops
2. Steel framing and supports for mechanical and electrical equipment
3. Steel framing and supports for applications where framing and supports are not specified in other sections.
4. Shelf angles
5. Loose bearing and leveling plates
6. Steel weld plates and angles for casting into concrete not specified in other Sections
7. Abrasive metal nosing

B. Products furnished but not installed under this Section include the following:

1. Loose steel lintels
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss. Temperature Change (Range): 120 deg. F, ambient; 180 deg. F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Metal nosings
2. Paint products
3. Grout

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. 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.

C. Samples for Verification: For each type and finish of extruded nosing.

D. Welding certificates

E. Qualification Data: For professional engineer. Must be licensed in the State of Florida.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1 “Structural Welding Code – Steel”
2. AWS D1.2 “Structural Welding Code – Aluminum”
3. AWS D1.3 “Structural Welding Code- Sheet Steel”

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other constructions contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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. Deliver such items to Project site in time for completion.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another section. Deliver such items to Project site in time for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include but are not limited to products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 Cold-Formed Steel Tubing

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3

1. Size of Channels: 1-5/8" x 1-5/8"
2. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.018" nominal thickness.

E. Cast Iron: ASTM A48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6

C. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B 632M, Alloy 6061-T6

2.5 FASTENERS

A. Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular, hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 63; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489

F. Machine Screws: ASME B18.6.3

G. Lag Bolts: ASME B18.2.1

H. Plain Washers: Round, ASME B18.22.1

I. Lock Washers: Helical, spring type, ASME B18.21.1

J. Cast-In-Place Anchors In Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by an qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according AWS specifications for metal alloy welding.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

1. Use primer with a VOC content of 420g/L (3.5lb/gal) or less when calculated according to 40 CFR, Subpart D (EPA Method 24)

C. Use primer-containing pigments that make it easily distinguishable from zinc-rich primer.

D. Galvanizing Repair Paint: High zinc-content-dust paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous paint: Cold-applied emulsion complying with ASTM D 1187.

F. Non-shrink, Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Pre-assemble items in the shop to the greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads. Where units are indicated to be cast into concrete, equip with integrally welded steel trap anchors, 1/8” by 1-

1/2", with a minimum 6" embedment and 2" hook, not less than 8" from ends and corners of units and 24" o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition shop drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8", unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls and where indicated.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4" bolts spaced not more than 6" from ends and 24" o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2" larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls and where indicated.

C. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication at exterior locations.

C. Prime plates with zinc rich primer, at interior locations not indicated to be galvanized.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other sections for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than tow integrally welded steel strap anchors for embedding in concrete.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

D. Prime interior miscellaneous steel trim, where not indicated to be galvanized with zinc-rich primer.

2.14 ABRASIVE METAL NOSINGS

A. Cast-metal Units: Cast aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated, and in lengths necessary to accurately fit openings or conditions.

1. Available Manufacturers:

American Safety Tread Co., Inc.
Balco, Inc.
Barry Pattern & Foundry Co., Inc.
Safe-T-Metal Co.
Wooster Products, Inc.

2. Nosings: Cross-hatched units, 3” wide with 1/4" lip for casting into concrete steps.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.15 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.16 STEEL & IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated To Receive Zinc-Rich Primer: SSPC-SP6/NACE No. 3, “Commercial Blast Cleaning”.
2. Interiors (SSPC Zone 1A): SSPC-SP3, “Power Tool Cleaning”

B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, “Paint Application Specification No. 1: Shop,

Field, and Maintenance Painting of Steel," for shop painting. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: As fabricated, unspecified.

C. Class L Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated. Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevations, with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to from hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no rough ness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete inserts, toggle bolts, through bolts, lag bolts, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers written instructions and requirements indicated on Shop Drawings.

B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink metallic grout.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING NOSING, TREADS AND THRESHOLDS

A. Center nosings on full tread widths.

B. For nosings embedded in concrete steps, align nosings flush with riser faces and level with tread surfaces.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05521

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes aluminum pipe and tube railings.

1.3 PERFORMANCE REQUIREMENTS

A. In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ ft. applied in any direction.

b. Concentrated load of 200 lbf applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.

b. Concentrated load of 200 lbf applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials both due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. 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.

C. Welding certificates

D. Qualification Data: Signed and sealed calculations and shop drawings shall be submitted by a Florida-licensed Professional Engineer.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to AWS D1.2 “Structural Welding Code, Aluminum”

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following

1. Blum, Julius and Co.

2. Braun, J.G., Company; a division of the Wagner Companies

3. Crane Veyor Corp.

4. Pisor Industries, Inc.

5. Wagner, R & B, Inc.; a division of the Wagner Companies

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Flanges and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 ALUMINUM

A. Aluminum: Provide 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 alloy and temper designated below for each aluminum form required.

B. Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52

C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6

F. Die and Hand Forgings: ASTM B 247, Alloy A356.0-T6

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6

2.4 FASTENERS

A. Provide the following: Aluminum railings, Type 304 stainless steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide chemical or torque-controlled expansion anchors; fabricated from corrosion-resistant materials with capability to sustain, without failure equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and ad required for color match, strength and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187

C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at the Project site to create pourable anchoring, patching and grouting compound.

1. Water Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Form work true to line and level with accurate angles and surfaces.

C. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

D. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws and similar items.

E. Connections: Fabricate railings with welded connections, unless otherwise indicated.

F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

G. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

H. Railings: 1-1/2" minimum diameter rails.

I. Form changes in direction by bending.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Provide inserts and other anchorage devices for connecting railings to concrete work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

C. Color to be selected by Architect from standard fluoropolymer colors.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete or dissimilar metals with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed; wipe off surplus anchoring material, and leave 1/8" buildup, sloped away from post.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum railings, attach posts using fittings designed and engineered for the purpose.

3.3 ADJUSTING AND CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap; rinse with clean water.

3.4 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 06105

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 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Rooftop equipment, bases and support curbs.
2. Wood blocking, grounds, cants and nailers.
3. Engineered lumber

B. Related Sections include the following:

1. Division 6 Section, Sheathing

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. NLGA: National Lumber Grades Authority
2. SPIB: The Southern Pine Inspection Bureau
3. WWPA: Western Wood Products Association

C. Engineered Lumber Products: Laminated veneer lumber

1.4 SUBMITTALS

A. 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 materials comply with requirements.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with Building Code in effect for Project:

1. Preservative-treated wood
2. Power-driven fasteners.
3. Expansion anchors.
4. Metal framing anchors.

1.5 DELIVERY, STORAGE AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. 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 lumber 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. Provide dressed lumber, S4S, unless otherwise indicated.

B. Wood beams at covered walkway shall be “Microlam”, manufactured by Weyerhauser Wood Products or approved equal.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

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.
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, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 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
5. Grounds

B. For items of dimension lumber size, provide construction or No. 2 grade lumber with 19% maximum moisture content and any of the following species:

1. Mixed southern pine: SPIB
2. Spruce-pine-fir (south): NeLMA, WCLIB, WWPA
3. Western woods: WCLIB or WWPA

C. For concealed boards, provide lumber with 19% 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, WWPA
2. Western woods, construction or No. 2 common grade: WCLIB, WWPA

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

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, Staples: ASTM F 1667
C. Power-Driven Fasteners: NES NER-272.
D. Wood Screws: ASME B18.6.1
E. Screws for Fastening Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, 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 four times the load imposed when installed in concrete as determined by testing agency 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.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.5 METAL FRAMING ANCHORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

1. Cleveland Steel Specialty Co.
2. Harlen Metal Products, Inc.
3. KC Metals Products, Inc.
4. Simpson Strong-Tie Company, Inc.
5. Southeastern Metals Manufacturing Co., Inc.
6. USP Structural Connectors

B. Galvanized Steel Sheet: Hot-dip, zinc coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive, rubberized asphalt compound, bonded to a high density, polyethylene film to produce an overall thickness of not less than 0.025".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough 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 "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
E. Do not splice structural members between supports.
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" o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96" o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2" nominal thickness.
2. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20' o.c.

H. Sort and select lumber so that natural characteristics will not interfere 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 copper naphthenate for items not continuously protected from liquid water.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated.

1. NES NER-272 for power driven fasteners.
2. Table 2304.9.1 "Fastening Schedule" in ICC's Florida Building Code.

K. Use common wire 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; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form 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.

END OF SECTION

SECTION 06160

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall sheathing

2. Roof sheathing

3. Building wrap

4. Flexible flashing at openings in sheathings.

5. Composite nail base insulated roof sheathing.

B. Related sections include Division 6 Section “Miscellaneous Rough Carpentry”

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For building wrap, include data on air/moisture-infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Building wrap

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior sheathing.

1. Span Rating: Not less than 24/0

2. Nominal Thickness: Not less than 1/2 inch

2.3 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, Staples: ASTM F 1667

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

D. Wood Fasteners: NES NER-272

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Sheathing Structural Panels to Metal Framing: Shall comply with 2007 Florida Building Code.

G. Screws for Fastening Oriented Strand Board Surfaced, Polyisocyanurate Foam Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. Provide washers or plates if recommended by sheathing manufacturer.

2.4 WEATHER RESISTANT SHEATHING PAPER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E 84; UV stabilized, and acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include but are not limited to the following:

a. Dow Chemical Company: Styrofoam Weathermate Plus Brand Housewrap

b. DuPont (E. I. duPont de Nemours and Company): Tyvek Commercial Wrap.

c. Raven Industries, Inc.: Rufco Wrap

d. Reemay, Inc.: Typar Housewrap

2. Water Vapor Permeance: Not less than 152g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).

3. Allowable UV Exposure Time: Not less than three months.

B. Building Wrap Tape: Pressure sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

B. Flexible Flashing: Composite, self-adhesive flashing product consisting of a pliable, rubberized asphalt compound, bonded to a high density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inc.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include but are not limited to the following:

a. Carlisle Coatings and Waterproofing: CCW-705-TWF Thru-Wall Flashing

b. Grace Construction Products, a unit of W. R. Grace & Co.: Vycor V40 Weather Barrier Strips.

c. MFM Building Products Corp: Window Wrap.

d. Polyguard Products, Inc.: Polyguard 300

e. Protecto Wrap Company: PS-45

C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. 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. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S “Engineered Wood Construction Guide,” for types of structural use panels and applications indicated.

B. Fastening Method: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Screw to cold-formed metal framing.

b. Space panels 1/8 inch apart at edges and ends.

3.3 WEATHER-RESISTANT SHEATHING PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion or control joint locations.

2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

B. Building Wrap: Comply with manufacturer’s written instructions

1. Seal seams, edges, fasteners, and penetrations with tape.

2. Extend into jambs of openings and seal corners with tape.

3.4 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer’s written instructions.

1. Prime substrates as recommended by flashing manufacturer.

2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.

3. Lap flashing over weather resistant building paper at bottom and sides of openings.

4. Lap weather resistant building paper over flashing at heads of openings.

5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

SECTION 06192

PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all materials, equipment and labor for the design, fabrication, delivery and permanent setting of all prefabricated wood trusses shown on the drawings.

1.02 QUALITY ASSURANCE

A. Comply with following applicable requirements and recommendations of following Truss Plate Institute (TPI) publications:

1. Design specification of metal plate connected wood trusses.
2. Commentary and recommendations for handling and erecting wood trusses.
3. Commentary and recommendations for bracing wood trusses.
4. Quality control manual.

B. Comply with the "National Design Specifications for Stress-Grade Lumber and its Fastenings", a N.F.P.A. publication.

1.03 SUBMITTALS

A. Submit shop drawings for approval. Shop drawings shall be stamped by a professional engineer registered in the State of Florida. Shop drawings shall show the layout of all trusses, mark numbers, and the details of each truss and loads used in the design of the trusses.

B. Contractor is responsible to design all trusses in accordance with T.P.I., recommendations, and the contract documents. The trusses shall be designed for all loads shown on the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use Southern Pine or Douglas Fir with a maximum moisture content at time of dressing of 19%, use No.2 grade or better.

B. Connector plates shall be galvanized conforming to ASTM A446, Grade A with G60 coating.

2.02 FABRICATION

A. All trusses shall be fabricated in accordance with the applicable T.P.I. recommendations.

PART 3 - EXECUTION

3.01 GENERAL

A. Erect and brace trusses to conform to the recommendations of the manufacturer and the truss plate institute.

B. Provide temporary bracing, as required.

C. Install permanent bracing as required; truss manufacturer shall design all permanent bracing. Contractor is responsible to furnish all material for the installation of all bracing shown on the drawings and shop drawings.

END OF SECTION

SECTION 06201

FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the following high-density urethane foam and cellular PVC trim:

1. Exterior running and standing trim.

B. Refer to Section 05400 Cold Formed Metal Framing for specialty engineering requirements for framing.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors, and include construction and application details.

B. Samples for Initial Selection: For each type of exterior finish carpentry indicated.

C. Samples for Verification: For each product with half of exposed surface finished; 50 sq. inches minimum for ornamental product and 8” x 10” for standing and running trim.

D. Maintenance Data: For exterior finish carpentry trim and accessories to include in maintenance manuals.

E. Warranties: Special warranties specified in this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in original packaging, unopened with no visible damage. Protect materials against weather and contact with damp or wet surfaces. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

B. Protect from high temperatures. Allow at least 24 hours for materials to adapt to conditions at Project site prior to installation. Protect materials from ultraviolet exposure.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed without exposure to rain or dampness.

B. Do not install finish carpentry materials that are damp, wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include but are not limited to discoloration, sagging, or irregular shape.

2. Indications that materials are mold-damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.6 WARRANTY

A. Special Warranty for Cellular PVC Trim: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to rotting, corrosion, delamination, shrinkage, and excessive swelling from moisture. Warranty period: Lifetime.

B. Lifetime Limited Warranty; That the exterior white primer paint finish will be free from UV ray degradation, blistering, and paint peeling under normal use for a period of one year from the date of purchase. Further provide a LIFETIME WARRANTY to the original purchaser on the urethane material. This LIFETIME WARRANTY provides that the urethane material will be free from defects in material and workmanship under normal use.

PART 2 – PRODUCTS

2.1 STANDING AND RUNNING TRIM

A. Foam Plastic Moldings (Formed Molding): Molded product of shapes indicated, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces shall not be shaped after molding. Product is recommended by manufacturer for exterior use.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Architectural Moldings, Ltd; Balmer Architectural Moldings Div.

b. Century Architectural Specialties LLC

c. Spectis Moulders, Inc.

d. Fypon, Ltd.

2. Density: Not less than 20 lbs/ cu. ft.

3. Flame-Spread Index: Not more than 75 when tested according to ASTM E 84

4. Patterns: As indicated

B. Cellular PVC Trim (Extruded Molding): Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fypon, Ltd.

b. Ply-Trim Inc.; DuraBoard

c. Royal Mouldings Ltd; Pro-Series Exterior Mouldings

d. Vycom Corp.; Azek

2. Density: Not less than 31 lbs/ cu. ft.

3. Heat Deflection Temperature: Not less than 130 deg F per ASTM D 648

4. Coefficient of Thermal Expansion: Not more than 4.5 x 10^{-5} inches x deg F

5. Water Absorption: Not more than 1 percent per ASTM D 570

6. Flame-Spread Index: 75 or less per ASTM E 84

7. Finish: Factory finish, no painting required.

2.2 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate. For applications not otherwise indicated, provide hot-dip galvanized steel fasteners

1. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.

B. Adhesive for Trim: Product recommended by trim manufacturer.

C. Insect Screening for Soffit Vents: Aluminum, 18-by-16 mesh.

D. Sealants: Use sealant products approved by the foam molding and cellular PVC trim manufacturer. Latex, complying with ASTM C 834, Type P, Grade NF and with applicable requirements in Division 7 Section "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Bostik Findley; Chem-Calk 600.

b. Pecora Corporation; AC-20+.

c. Schnee-Morehead, Inc.; SM 8200.

d. Sonneborn, Division of ChemRex Inc.; Sonolac.

e. Tremco; Tremflex 834.

f. Manufacturer Installation Kits

2.3 FABRICATION

A. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

2.4 FACTORY FINISHES

A. Provide manufacturers protective barrier two-coat primer; resistant to UV degradation, providing interim UV protection of products which is suitable for field application of latex finish paints on all polyurethane foam products.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates with installer present for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Do not use material which is unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements. Do not use manufactured units with defective surfaces, sizes or patterns.

B. Install exterior carpentry level, plumb and true and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Install to a tolerance of 1/8” in 96” for level and plumb. Install adjoining exterior finish carpentry with 1/32” maximum offset for flush installation and 1/16” maximum offset for reveal installation.

3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

C. Unless otherwise indicated, countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

D. Install sealant in accordance with manufacturer’s recommendation.

E. Install adhesives at joints and for fastening in accordance with manufacturer’s recommendations.

F. Apply finish paint to all exposed surfaces.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install trim to comply with manufacturer’s written instructions.

B. Install trim with minimum number of joints practical, using full length pieces from maximum lengths of lumber available. Do not use pieces less than 24” long except where necessary.

1. Use scarf joints for end-to-end joints

2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water. Cope at returns and miter and corners to produce tight fitting joints with full surface-contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

3.5 ADJUSTING

A. Replace exterior finish carpentry work that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or re-finished if work complies with requirements and shows no evidence of repair or re-finishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean exterior finish carpentry on exposed and semi-exposed surfaces. Touch-up factory applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged or mold damaged.

1. Indications that materials are wet or moisture damaged include but are not limited to discoloration, sagging, or irregular shape.

2. Indications that materials are mold-damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the following:

1. Plastic laminate cabinets
2. Plastic laminate countertops
3. Solid-surfacing-material countertops
4. Utility shelving
5. Wood window sills
6. Wood butcher-block countertops and backsplash
7. Finish wood trim

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.

B. 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 plumbing fixtures and other items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Plastic laminates
2. PVC edge material
3. Wood butcher-block (maple)
4. Solid-surfacing materials.

D. Samples for Verification:

1. Plastic laminates, 8x10 inches, for each type, color, pattern, and surface finish.
2. Solid-surfacing materials, and wood butcher-block, 6 inches square.
3. Lumber for transparent finish, not less than 5 sq. in. for each species with 1/2 of exposed surface finished.
4. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Product Certificates: For each type of product, signed by product manufacturer.

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

G. Qualification Data: For Installer and Fabricator.

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. Source Limitations: Engage a qualified woodworking film to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements. Provide AWI's Quality Certification Program certificates including that woodwork, including installation, complies with requirements of grades specified.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork 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 the woodwork by field measurements before being enclosed, and indicate measurements on the Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. 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 interior architectural woodwork can be supported and installed as indicated.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Red oak, plain sawn or sliced

C. Wood Species for Opaque Finish: Any closed-grain hardwood.

D. Wood Products: Comply with the following:

1. Softwood Plywood: DOC PS1, Medium Density Overlay
2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include but are not limited to the following:

a. Formica Corporation
b. Nevamar Company LLC; Decorative Products Div.
c. Wilsonart International; Div. of Premark International, Inc.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

F. Solid-Surfacing Material: Homogenous solid sheets of filled plastic resin complying with ISSFA-2.

1. Basis of Design: Wilsonart International; Div. of Premark International, Inc., Gibraltar, or a comparable product of one of the following:

a. Avonite, Inc.
b. E. I. duPont de Nemours and Company
c. Formica Corporation
d. Nevamar Company, LLC, Decorative Products Div.
e. Swan Corporation.

2. Type: Standard type, unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

G. Butcher-block wood countertops: Style "SCT", hard rock maple top and backsplash. 1-1/2" thick edge grain with "Varnique" finish as manufactured by John Boos & Co.

2.2 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Wire Pulls: Back mounted solid metal, 5" long, 1-1/2" deep, and 5/16" in diameter. Satin chrome-plated.

D. Adjustable Shelf Standards and Supports, Typical Cabinets: BHMA A156.9, B04071; with shelf rests, B04081.

E. Drawer Slides: BHMA A156.9, B05091. Heavy Duty (Grade 1HD-200); side-mounted, full extension type; zinc plated steel ball-bearing slides.

F. Door Locks: BHMA A156.11, E07121. Keyed alike for each classroom or office keyway. Coordinate keying with College Facilities Manager.

G. Drawer Locks: BHMA A156.11, E07041. Keyed alike for classroom or office keyway. Coordinate keying with College Facilities Manager.

H. Grommets for Cable Passage through Countertops: 1-1/4" OD, color as selected to match countertop. Molded-plastic grommets and matching plastic caps with slot for wire passage. Product: Subject to compliance with requirements: provide "OG" Series by Doug Mockett & Company, Inc.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated. Satin Chrome Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

J. For concealed hardware, provide manufacturers standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims and Hanging Strips: Fire-retardant treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in place anchors.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30g/L
2. Contact Adhesive: 250g/L

F. Adhesive for Bonding Plastic Laminate: Contact cement. Adhesive for Bonding Edges: Hot melt adhesive or adhesive specified above for faces.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide custom-grade interior woodwork complying with referenced quality standard.

B. Fabricate woodwork to dimensions, profiles and details indicated. Ease edges to radius indicated for exposed corners and edges of solid-wood (lumber) members 3/4" thick or less: 1/16”

C. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

D. Complete fabricating, including assembly, finishing 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.

E. 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 indicated on shop drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, 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. Seal edges of openings in countertops with one coat of varnish.

G. Install glass to comply with applicable requirements in Division 8 section “Glazing” and in GANA’s “Glazing Manual”

2.5 PLASTIC LAMINATE CABINETS

A. Grade: Custom

B. AWI Type of Cabinet Construction: Flush overlay

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGL
2. Vertical Surfaces: Grade VGS
3. Edges: Grade VGS

D. Materials for Semi-Exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-Pressure Decorative Laminate, Grade VGS.

a. Edges of Plastic Laminate Shelves: PVC edge banding, 0.12" thick, matching laminate in color, pattern and finish.
b. For semi-exposed backs of panels with exposed plastic laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS

2. Drawer Slides and Backs: Thermoset decorative panels
3. Drawer Bottoms: Thermoset decorative panels

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. 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. Match Architect's sample
3. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish
b. Metal clad high-pressure laminate.

2.6 PLASTIC LAMINATE COUNTERTOPS

A. Grade: Custom

B. High-Pressure Decorative Laminate Grade: HGS

C. 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 selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish

D. Edge Treatment: Same as laminate cladding on horizontal surfaces, as indicated.

E. Core Material: Exterior grade plywood.

F. Core Material at Sinks: Exterior grade plywood or marine grade plywood.

G. Paper Backing: Provide paper backing on underside of countertop substrate.

2.7 WOOD BUTCHER-BLOCK MATERIAL COUNTERTOPS

A. Style: “SCT”

B. Laminated Hardrock Maple Top Thickness: 1-1/2"

C. Finishes: Provide materials and products with manufacturer’s “Varnique” factory-finish:

a. As selected by Architect from manufacturer’s full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing material manufacturer’s written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with loose backsplashes for field applications.

PART 3 – EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for the fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at the Project site to comply with requirements for fabrication in Part 2, to the extent that it was not completed in the shop.

C. Install woodwork level, plumb, true and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8” in 96”.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit 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” in 96” sag, bow or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends, and not more than 16” o.c. with No. 10 wafer-head screws sized for 1” penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing material countertops and form seams to comply with manufacturer’s written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install cabinets with no more than 1/8” in 96” sag, bow or other variation from a straight line.
3. Secure backsplashes to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 section “Joint Sealants”

H. Touch up finishing work specified in this section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop applied finishes restoring damaged or soiled areas.

3.4 GUARANTEE

A. All materials shall be guaranteed for a period of five (5) years from manufacturer’s defects and workmanship.

END OF SECTION

SECTION 06455

SYNTHETIC WOOD TRIM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Synthetic Wood Trim boards

1.3 RELATED SECTIONS

A. Section 06105 – Miscellaneous Rough Carpentry

B. Section 09900 – Painting

1.4 REFERENCES

A. ASTM D 792 – Density and Specific Gravity of Plastics by Displacement

B. ASTM D 570 – Water Absorption of Plastics

C. ASTM D 638 – Tensile Property of Plastics

D. ASTM D 790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

E. ASTM D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

F. ASTM D 1761 – Mechanical Fasteners in Wood

G. ASTM D 5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by means of a Striker Impacted by Falling Weight

H. ASTM D 256 – Determining the Pendulum Impact Resistance of Plastics

I. ASTM D 696 – Coefficient of Linear Thermal Expansion of Plastics between -30 deg C and 30 deg C with a Vitreous Silica Dilatometer

J. ASTM D 635 – Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

K. ASTM E 84 – Surface Burning Characteristics of Building Materials.

L. ASTM D 648 – Deflection Temperature of Plastics under Flexural Load in Edgewise Position.

M. ASTM 3679 – Standard Specification for Rigid Polyvinyl Chloride (PVC) Siding.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300

B. Product Data: Manufacturer's data sheets on each product to be used, including preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods, including nailing patterns.

C. Verification Samples: For each finish profile specified, two samples, minimum size 6 inches long, representing actual product and patterns finish.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A minimum of 10 years in the manufacture of PVC products.

B. Installer Qualifications: A minimum of three years in the installation of PVC products.

C. Mock-up: Provide a mock-up for evaluation of profiles and installation techniques and workmanship.

1. Roof and fascia areas designated by Architect.
2. Include mock-up for each profile combination indicated on the Drawings.
3. Do proceed with the remaining work until workmanship, color and sheen are approved by Architect. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Warranted to the Owner under normal and proper use to be free of manufacturing defects for a period of twenty-five (25) years.

1.10 COORDINATION

A. Coordinate work with other operations and installation of trim to avoid damage to installed materials.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: CertainTeed Corporation, CertainTeed Restoration Millwork, Siding Products Group, P. O. Box 860, Valley Forge, PA 19482; Tel: 800-233-8990. Fax: 610-341-7940. Email: ctsiding@certainteed.com

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIAL

A. General: CertainTeed Restoration Millwork is a Freefoam Cellular PVC that is homogenous and free of voids, holes, cracks, and foreign inclusions and other defects. Edges must be square and top and bottom surfaces shall be flat with no convex or concave deviation.

B. Physical Properties: Free foam cellular PVC material with a small-cell microstructure of 0.60 grams/cm3 in accordance with ASTM D 792 with the following physical and performance properties:

1. Mechanical:

a. Tensile Strength: 1261 psi when tested in accordance with ASTM D 638.
b. Tensile Modulus: 79,463 psi when tested in accordance with ASTM D 638.
c. Flexural Strength: 4082 psi when tested in accordance with ASTM D 790.
d. Nail Hold: 66 (finish nail) lbf/in of penetration when tested in accordance with ASTM D 1761.
e. Gardner Impact: 16 in-lbs when tested in accordance with ASTM D 4226.
f. Charpy Impact (23 deg C): 0.1526 ft-lbs/in when tested in accordance with ASTM D 256.

2. Thermal:

a. Coefficient of Linear Expansion: 3.2 x10-5 in/in/deg F when tested in accordance with ASTM D 696.
b. Burning Rate: No burn when flame removed when tested in accordance with ASTM D 635.
c. Flame Spread Index: 20 when tested in accordance with ASTM E 84.

3. Tolerances:

a. Variation in component length: minus 0.00 plus 1.00 inch.
b. Variation in component width: plus or minus 1/16 inch.
c. Variation in component edge cut: plus or minus 2 degrees.
d. Variation in Density: minus 0 percent to plus 10 percent.

C. Workmanship, Finish and Appearance: Products are provided with a natural white color and a smooth finish on both sides. Products do not require paint for protection but may be painted to achieve a custom color

2.3 SYNTHETIC WOOD TRIM

A. General: Provide synthetic wood trim to the following profiles and to the configurations indicated on the Drawings.

B. Trim Boards Type C:

1. Nominal Thickness: 1 inch (25.5 mm).
2. Nominal Width:

a. 4 inches (102 mm).
b. b. 6 inches (152 mm).
c. c. 8 inches (203 mm).
d. d. 10 inches (254 mm).
e. e. 12 inches (305 mm).

3. Nominal Length: 18 feet (5.48 m).
4. Finish: Smooth Natural White.

2.4 ACCESSORIES

A. Fasteners:

1. Use fasteners designed for wood trim and siding (thinner shank, blunt point, full round head).
2. Use a highly durable fastener such as stainless steel or hot dipped galvanized steel.
3. Staples, small brads and wire nails must not be used as fastening members.
4. Fasteners should be long enough to penetrate a solid wood substrate a minimum of 1-1/2 inch (38 mm).
5. The use of standard nail guns is acceptable.
6. Use two fasteners per every framing member for trimboard applications. Use additional fasteners for trimboards 12 inches (305 mm) or wider, as well as sheets.
7. Install fasteners no more than 2 inches (51 mm) from the end of the board.
8. Fasten trim into a flat, solid substrate. Fastening trim into hollow or uneven areas must be avoided.
9. Pre-drilling is typically not required unless a large fastener is used or product is being installed in low temperatures.

B. Adhesives:

1. Glue all trim joints (scarf or miter) with a cellular PVC cement/adhesive such as Gorilla PVC or Bond & Fill.
2. Glue joints should be secured with a fastener and/or fastened on each side of the joint to allow adequate bonding time.
3. Surfaces to be glued should be smooth, clean and in complete contact with each other.
4. Various adhesives may be used. Consult adhesive manufacturer to determine suitability.

C. Sealants:

1. Use urethane, polyurethane or acrylic based sealants without silicone as specified in Section 07920.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Prior to installation, verify governing dimensions of and condition of substrate.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions. Comply with all terms necessary to maintain warranty coverage. Use trim details indicated on Drawings. Touch up all field cut edges before installing.

B. Cutting: Use conventional woodworking saws. Use carbide tipped blades designed to cut wood. Do not use fine-tooth metal-cutting blades or plywood blades. Avoid rough edges from cutting caused by: excessive friction, poor board support, worn saw blades or badly aligned tools.

C. Drilling: Drill with standard woodworking drill bits. Do not use bits made for rigid PVC. Avoid frictional heat build-up and remove shavings from the drill hole frequently.

D. Milling: Mill using standard milling machines used to mill lumber. Relief angle 20 to 30 degrees. Cutting speed to be optimized with the number of knives and feed rate.

E. Routing: Rout using standard bits and the same tools to rout lumber. Carbide tipped router bits are recommended.

F. Edge Finishing: Edges can be finished by sanding, grinding, or filling with traditional woodworking tools.

G. Nail Location: Use two fasteners per every framing member for trimboard applications. Trim boards over 12 inches (305 mm) or wider, as well as sheets, will require additional fasteners. Install fasteners no more than 3/4 inches (19 mm) from the end of each board.

H. Thermal Expansion and Contraction: Expansion and contraction will occur with changes in temperature. When properly fastened, allow 1/4 inch (6 mm) per 18 foot (5.49 m) for expansion and contraction. Joints between pieces should be glued to eliminate joint separation. When gaps are glued on a long run, allow for expansion and contraction at the end of the runs.

I. Finishing: Correct dents and gouges before applying final coating. Prepare surfaces and paint materials as recommended by the molding manufacturer. Paint as specified in Section 09900. If moldings get dirty during installation, clean with a soft bristle brush and a bucket of soapy water. For stubborn stains, mold or mildew, use a cleaner suitable for PVC products.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 06610

ARCHITECTURAL FIBER REINFORCED PLASTIC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, conditions of the contract and Division 1 Specifications sections, apply to work of this section.

1.02 SUMMARY

A. Section Includes: Architectural Fiberglass Reinforced Plastic fabrications as required to replace or rebuild existing materials.

1. Exterior building dental moulding
2. Exterior building cornices

1.03 RELATED SECTIONS

A. Section 06105 – Miscellaneous Rough Carpentry: Framing of Opening and Blocking.
B. Section 07900 - Joint sealants and field applied sealants.

1.04 REFERENCE STANDARDS

A. ASTM D 638: Test Method for Tensile Properties of Plastic
B. ASTM D 695: Test Method for Compressive Strength of Rigid Plastics
C. ASTM D 790: Test Methods for Properties of Unreinforced Plastics and Electrical Insulating Materials.
D. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.

1.05 DESIGN REQUIREMENTS

A. Installed architectural fiberglass fabrications and fastening systems shall be designed, engineered, fabricated, and installed to conform to the state codes, local codes, and to match the existing design.

1.06 SUBMITTALS

A. Shop Drawings: Shall illustrate dimensions, adjacent construction, materials, thickness, fabrications details, required clearances, field jointing, tolerances, colors, finishes, methods of support, and integration of components and anchorages.

1. Textures of proposed materials shall be as selected by Architect from the manufacturer's entire range of available textures and finishes.

B. Submit list of part numbers that coordinate with labeled architectural fiber reinforced plastic parts.

C. Product Data: Submit manufacturer's product data and installation instructions.

D. Manufacturer's Instructions: Submit manufacturer's instructions and recommendations for product delivery, storage and handling.

E. Product Samples: Submit minimum 3-inch x 5-inch samples in specified color, texture and finish.

F. Submit manufacturer's warranty.

G. Shop Drawings shall be signed and sealed by Engineer registered in the State of Florida.

1.07 QUALITY ASSURANCE

A. Obtain architectural fiberglass from a single source manufacturer that has the ability and resources to comply with the requirements and schedule of the project.

B. Inspect each molded piece to ensure that it complies with specified requirements, including nominal dimensions.

1.08 MANUFACTURER'S QUALIFICATIONS

A. Manufacturer: Provide products manufactured by a firm specializing in the manufacture of fiberglass architectural ornamentation, in the United States with a minimum of ten (10) years experience.

B. Provide a list of projects comparable in size, scope, and complexity as indicated, upon request.

C. Provide verification that architectural fiberglass meets or exceeds products specified.

1.09 DELIVERY, STORAGE AND HANDLING

A. Handle, store and transport architectural fiberglass fabrications according to manufacturer's recommendations and in a manner that prevents damage.

B. Protect architectural fiberglass from damage by retaining shipping protection in place until installation.

C. Damage Responsibility: Except for damage caused by others, the installer is responsible for chipping, cracking, or other damage to fiberglass fabrications, after delivery to the jobsite and until installation is completed and inspected and approved by the Architect or Owner's representative.

1.10 WARRANTY

A. Warrant architectural fiberglass fabrications to be free from defect due to materials and workmanship for ten years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

Architectural Fiberglass, Inc.
Aristone Concrete Designs
CBL Architectural Fiberglass
DEC Architectural Composites
Fibertech Corporation
Florida Columns
Stromberg Architectural Products
Timeless Architectural Reproductions

2.02 FABRICATION PATTERNS/MOLDS

A. Custom architectural fiber reinforced plastic decorative ornamentation

B. Custom Molds: Molds shall be produced with ample layers of tooling resin, tooling gel-coat, glass fibers. Produced molds shall have rigidity and thickness to prevent distortion and deflection of molded architectural fiberglass.

2.03 MATERIALS CHARACTERISTICS

A. MOLDED EXTERIOR SURFACE: U-V inhibited, NPG-ISO polyester gel coat, 18 to 22 mils thick. Color to match in texture and finish of sample supplied by Architect.

1. Gel Coat Color: Match in texture and finish of sample provided by Architect.

B. BACK UP LAMINATE:

1. Resin: Isophthalic polyester resin.

a. Fire retardant: ASTM E 84m Class 1 flame spread rating of 25 or less.

2. Fiberglass Reinforcement:

a. "E" type fiberglass
b. Random chopped glass fibers.
c. Glass content approximately 20% to 30%.

3. Laminate Thickness:

a. Nominal thickness: 3/16"
b. Additional thickness and reinforcement, and sandwich structure added as indicated and as required for structural integrity.

2.04 AVERAGE MECHANICAL PROPERTIES:

PROPERTY	VALUE	TEST METHOD
Tensile Strength	12,000 PSI	ASTM D638
Flexural strength	20,000 PSI	ASTM D790
Flexural modulus	0.9 x 106 PSI	ASTM D790
Compressive strength	17,000 PSI	ASTM D695
Bearing strength	9,000 PSI	ASTM D638
Thermal expansion	10 x 10-6 (° F)	
Specific gravity	1.5	

2.05 FINISH

A. Color as selected by Architect or Owner's representative.
B. Surface Texture/Exposed side shall be smooth or textured based upon approved sample.

2.06 TOLERANCES

A. Part Thickness: + or – 1/8 inch.
B. Gel Coat Thickness: + or – 2.5 mils.
C. Length: + or – 1/8 inch.
D. Variation from Square: 1/8 inch.
E. Hardware Location Variation: + or – 1/4 inch.

2.07 IDENTIFICATION

A. Identify each architectural fiberglass unit with a permanent serial number.
B. Number parts to coordinate with shop drawings.

2.08 CURING AND CLEANING

A. Cure and clean components prior to shipment and remove material which may be:

1. Toxic to plant or animal life.
2. Incompatible with adjacent building material.

2.09 ANCHORS AND FASTENERS

A. Provide anchors and fasteners and other accessories for proper installation of architectural fiberglass fabrications as recommended and approved by fiberglass fabrication manufacturer.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION EXAMINATION

A. Carefully observe and verify field conditions that substrates are ready for installation of architectural fiberglass fabrications. Contractor shall verify on site dimensions with shop drawings and assume full responsibility for fitting the components to the structure.

B. Verify that bearing surfaces are true and level.

C. Verify that support framing has been constructed to allow accurate placement, alignment and connection of architectural fiberglass fabrications to structure.

D. Report discrepancies between design dimensions and field dimensions, which could adversely affect installation, to the Architect.

E. Do not proceed with installation until discrepancies are corrected, or until installation requirements are modified and approved by the Architect.

F. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install architectural fiberglass fabrications in accordance with manufacturer's instructions and approved shop drawings.

3.03 ALLOWABLE TOLERANCES FOR INSTALLED UNITS

A. Maximum offset from True Alignment: 1/4 inch in 20 feet.
B. Maximum Variation from True Position: 1/2 inch in 20 feet.

3.04 CLEANING

A. Clean installed architectural fiberglass fabrications using cleaning methods and material approved by manufacturer.

3.05 PROTECTION OF INSTALLED FABRICATIONS

A. Comply with manufacturer's recommendations and instructions for protecting installed fabrications during construction activities.

END OF SECTION

SECTION 07015

PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Roof tear-off.
2. Roof re-cover preparation.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.3 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 the project site.

1.4 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 Roofing System: Asphalt Shingle Roofing, roof insulation, and components and accessories between deck and roofing membrane.

C. Roof Tear-Off: Removal of existing shingle roofing system from insulated deck.

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

E. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.5 SUBMITTALS

A. Fastener pull-out test report.

B. 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 re-roofing operations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of new membrane roofing system with a minimum of 5 years experience in reroofing.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Re-roofing Conference: Conduct conference at project site.

1. Meet with Owner, Architect, Owner's insurer (if applicable), testing and inspecting agency representative, roofing system manufacturer's representative, roofing installer including project manager, superintendent and foreman, and installers whose work interfaces with or affects re-roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing-system tear-off and replacement including but not limited to the following:

a. Re-roofing preparation, including roofing system manufacturer's written instructions.
b. Temporary protection requirements for existing roofing system that is to remain during and after installation.
c. Existing roof drainage during each state of re-roofing, and roof drain plugging and plug removal requirements.
d. Construction schedule and availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
e. Existing deck repair procedures and Owner notifications.
f. Condition and acceptance of existing insulated roof deck and base flashing substrate for reuse.
g. Structural loading limitation of deck during re-roofing.
h. Base flashing, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect re-roofing.
i. HVAC shutdown and sealing of air intakes.
j. Shutdown of fire-suppression, -protection, and –alarm and –detection systems.
k. Governing regulations and requirements for insurance and certificates if applicable.
l. Existing conditions that may require notification of Architect before proceeding.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately below the re-roofing area. Conduct re-roofing so Owner's operations will not be disrupted. Provide Owner with no less than 72 hours 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.
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 before proceeding with work over impaired deck area.

B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

C. Maintain access to existing walkways, drives, and other adjacent occupied or used facilities.

D. Owner will maintain conditions existing at time of inspection for bidding as far as practical.

1. Construction drawings for existing roofing system will be made available at Contractor's request for Contractor's reference. Contractor is responsible for conclusions derived from existing documents.

E. Limit construction loads on roof to rooftop equipment wheel loads and uniformly distributed loads.

F. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

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 Owner. Owner will remove hazardous materials under a separate contract.

PART 2 - PRODUCTS

2.1 INFILL MATERIALS

A. Use infill materials matching existing roofing system materials unless otherwise indicated.

1. Infill materials are specified in Division 7 sections

2.2 TEMPORARY ROOFING MATERIALS

A. Design and selection of materials for temporary roofing are responsibilities of the Contractor.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing roofing system that is indicated not to be re-roofed.

1. Limit traffic and material storage to areas of existing roofing that have been protected.
2. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of re-roofing.

B. Coordinate with Owner to shut down air intake equipment in the vicinity of the Work. Cover air intake louvers to prevent entry of air that could affect indoor air quality or activate smoke detectors in the ductwork.

C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

D. Verify that rooftop utilities and service piping have been shut off before commencing Work.

3.2 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

B. Roof Tear-Off: Remove existing roofing and other roofing system components, including ballast (if any), down to the deck. Remove fasteners from deck.

3.3 DECK PREPARATION

A. 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.

B. Provide additional deck securement as indicated on Drawings.

C. Replace deck as indicated on Drawings. Replacement deck is specified in Division 06.

3.4 EXISTING BASE FLASHINGS AND COUNTERFLASHINGS

A. Remove existing base flashings around parapets, curbs, walls, and penetrations as indicated.

1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.

3.5 FASTENER PULL-OUT TESTING

A. Perform fastener pull-out tests according to ANSI/SPRI FX-1, and submit test report to Architect and roofing manufacturer before installing new roof system.

1. Obtain Architect's and roofing manufacturer's approval to proceed with specified fastening pattern. Architect and roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.
2. No additional funds will be allowed for changes to fastening pattern.

3.6 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 is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

SECTION 07200

INSULATION

1.1 GENERAL:

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

B. Thermal resistivity or r-value represents the rate of heat flow through a homogenous material exactly 1" thick and are expressed by the temperature difference in degrees F between the two exposed faces required to cause 1 BTU to flow throughout 1 sq. ft. per hr. at mean temperatures indicated.

C. Fire Performance Characteristics: Provide insulation with fire performance characteristics indicated per ASTM E 119, ASTM E 84 and E 136, as applicable, and which correspond to products listed in UL "Fire Resistance Directory" or "Building Materials Directory".

D. Maximum Allowable Asbestos Content: Less than 0.25% by weight of asbestos of any type or mixture of types occurring naturally as impurities, as determined by polarized light microscopy test per Appendix A of 40 CFR 763.

E. Submittals: Submit product data for each form and type of insulation indicated.

1.2 PRODUCTS:

A. General: Provide preformed units in sizes to fit applications indicated, selected from manufacturer's standard thickness, widths and lengths.

B. Extruded Polystyrene Board Insulation: ASTM C 578, Type as indicated below; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F (4.4 and 23.9 deg. C), respectively; and as follows:

1. Type IV, 1.6 lb./cu. ft. min density.
2. Type V, 3.0 lb./cu. ft. min. density where indicated.
3. Type VI, 1.8 lb./cu. ft. min. density.
4. Type VII, 2.2 lb./cu. ft. min. density.
5. Type X, 1.35 lb./cu. ft. min. density.
6. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.

C. Molded Polystyrene Board Insulation: ASTM C 578, Type as indicated below:

1. Type I, 0.9 lb./cu. ft. min. density, aged r-value of 4.0 and 3.6 at 40 and 75° F (4.4 and 23.9° C), respectively.

2. Type II, 1.3 lb./cu. ft. min. density, aged r-value of 4.4 and 4.0 at 40 and 75° F (4.4 and 23.9° C), respectively.

3. Type VIII, 1.15 lb./cu. ft. min. density, aged r-value of 4.2 and 3.8 at 40 and 75° F (4.4 and 23.9° C), respectively.

4. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 75 and 175, respectively.

D. Phenolic Board Insulation: Rigid, cellular thermal insulation with thermoset phenolic-based closed-cell-foam core and 2-ply foil-kraft-liner facing laminated to both sides, aged r-value of 8.33 per ASTM C 518.

1. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 15, respectively.

E. Faced Mineral Fiber Blanket/Batt Insulation: ASTM C 665 for Type II, Class A (blankets with vapor-retarder membrane facing with flame spread of 25 or less); kraft vapor-retarder membrane on one face, respectively; and as follows:

1. Mineral Fiber Type: Fibers manufactured from glass or slag.

F. Polyisocyanurate rigid insulation board, equal to 'Firestone' ISO 95+. Provide flat and tapered boards as required. Rigid insulation at curved roof shall be built up to the required thickness from layers of 1" thick boards. LTTR = 6.0 per inch.

G. Combustion Characteristics: Unfaced materials passes ASTM E 136 test.

1. Surface Burning Characteristics: Maximum flame spread and smoke developed value of 25 and 50, respectively.

H. Mechanical Anchors: Type and size recommended by insulation manufacturer.

I. Spray foam insulation shall be polyicynene insulation as manufactured by Icynene, Inc., or approved equal. The spray formula shall be a 1/2 pound density, free rise, open celled material.

J. Sound batt insulation (STC 50) shall be similar and equal to JM Formaldehyde-Free Thermal/Acoustical Fiberglass Batts"

1.3 INSTALLATION:

A. General: Comply with insulation manufacturer's instructions for installation of insulation.

B. Support insulation units by adhesive or mechanical anchorage or both as applicable to location and conditions indicated.

END OF SECTION

SECTION 07214

FOAM PLASTIC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Applications of insulation specified in this section include the following:

1. Foam Plastic Thermal Insulation: Nitrogen-based, non-toxic amino-plast resin, foaming catalyst and air.

1.2 QUALITY ASSURANCE

A. Insulation shall be installed as per manufacturer's recommendations.

B. The firm performing work on this project shall have at least five (5) consecutive years of documented experience with the installation of foam plastic masonry wall insulation.

C. Foam plastic insulation resin must come from the manufacturer pre-mixed to insure consistency.

PART 2 - PRODUCTS

2.1 Product shall be similar and equal to the product of:

Tailored Chemical Products, Inc.
(CORE-FILL 500 Insulation)
3719 1st Avenue Southwest
Hickory, NC 28601
Tel: 704/322-6512

Florida and Southern Georgia Distributor:
Tailored Foam of Florida, Inc
P. O. Box 520986
Longwood, FL 32752
Tel: 407/332-0333; Fax: 407/830-9174

PART 3 - EXECUTION

3.1 INSTALLATION

A. CORE-FILL 500 shall be installed in the interior space of all structural steel tube frames that have an interior/exterior exposure. Installation of the foam insulation shall be after the structural steel tube frames are in place. A 7/8" hole shall be drilled in each vertical column of block cells 4'+/- above the floor level. The foam shall be pressure injected into the cells at 120 - 160 p.s.i. This procedure shall be repeated ever 10' +/- (i.e. 14', 24' 34'…) of wall height until the void is completely full. The installer shall then patch their holes with mortar and score to resemble existing surface.

B. Extent of insulation is the interior of all exterior exposed structural steel frames.

END OF SECTION

SECTION 07311

ASPHALT SHINGLES

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. Asphalt shingles.
2. Underlayment.
3. Eave and rake starter strips

B. Related Sections include the following:

1. Division 06 Section “Miscellaneous Rough Carpentry” for wood framing.
2. Division 06 Section "Sheathing" for roof deck wood structural panels and roof sheathing.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings and counterflashings.

1.3 DEFINITION

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For the following products, of sizes indicated, to verify color selected.

1. Asphalt Shingle: Full-size
2. Ridge and Hip Cap Shingles: Full-size
3. Self-adhering Underlayment: 12 inches square.
4. Synthetic Underlayment: 12 inches square.

C. Qualification Data: For qualified installer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

E. Research/Evaluation Reports: For each type of asphalt shingle required, from the FBC.

F. Maintenance Data: For each type of asphalt shingle to include in the maintenance manuals.

G. Warranties: Sample of manufacturer’s standard and/or special warranties, and sample of roofing installer’s workmanship warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer’s authorized representative who is trained and approved for installation of units required for this project.

B. Source Limitations: Obtain ridge and hip cap shingles and ridge vents from single source from a single manufacturer.

C. Pull testing of fasteners shall be performed by the roofing manufacturer.

D. Fire-Resistance Characteristics: Where indicated, provide asphalt shingle and related roofing materials identical to those of assemblies tested for fire-resistance per test method below or by UL, ASTM or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Exterior Fire-Test Exposure: ASTM E108 (latest version) or UL 790 (Class A), for application and roof slopes indicated.

E. Wind Resistance Characteristics: Where indicated, provide asphalt shingle and related roofing materials identical to those of assemblies tested for wind resistance per test method below or by ASTM or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Uplift Force/Uplift Resistance Method: D3161 (Class F); WK Revision of D3161-06; ASTM D 7158
2. Wind Resistance of Asphalt Shingles (Fan Induced Method): ASTM D 3161 (Class F); ASTM D 7158.

F. 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 for asphalt shingles including related roofing materials. Size: 48 inches long by 48 inches wide.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in the mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at project site. Review methods and procedures related to roofing system including, but not limited to the following:

1. Meet with Owner, Architect, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule and verify availability of materials, installer's personnel, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Provide manufacturer’s standard warranty.

B. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.

1. Failures include but are not limited to the following:

a. Manufacturing defects
b. Structural failures, including failure of asphalt shingles to self-seal after a reasonable time.

2. Material Warranty Period: Forty (40) years from date of Substantial Completion, prorated, with first ten (10) years non-prorated.
3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 130 mph for Ten (10) years from date of Substantial Completion.
4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor ten (10) years from date of Substantial Completion.
5. Workmanship Warranty Period: Two (2) years from date of Substantial Completion.

C. Special Project Warranty: Roofing Installer's warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees at no cost to the Owner to repair or replace components of the asphalt shingle roofing system that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Two (2) years from Substantial Completion

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft. of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Multi-tab Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Manufacturers: Subject to compliance with requirements, provide all roofing products by Owens-Corning Roofing Products LLC, 1 Owens-Corning Pkwy, Toledo, OH 43659, Tel: 800-438-7465.
2. Tab Arrangement: Wide cut, random width, laminated
3. Cutout Shape: Tapered
4. Butt Edge: Straight or stagger cut
5. Strip Size: Manufacturer's standard
6. Algae Resistance: Granules treated to resist algae discoloration (10 Year Warranty)
7. Color and Blends: Sierra Gray

B. Hip and Ridge Shingles: Owens-Corning standard units to match asphalt shingles.

C. **NO SUBSTITUTIONS.**

2.2 UNDERLAYMENT MATERIALS

A. Synthetic Roofing Underlayment: Minimum 12 mils thick consisting of slip-resistant polypropylene base sheet coextruded on both sides with UV stabilized polyolefin.

1. Physical requirements of ASTM D 226 Type I and II
2. ASTM E 108 / UL 790 Class A fire classification
3. ICC-ES Legacy Report ER-5843 for roofing underlayment
4. Miami-Dade County, FL NOA No. 05-0329-01

B. Self-Adhering High Temperature Sheet: Minimum 30 to 40 mils thick consisting of slip-resisting, polyethylene film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F
2. Low Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings and Waterproofing, Inc.; CCW WIP 300HT
b. Grace Construction Products, a unit of W. R. Grace & Co; Ultra
c. Henry Company; Blueskin PE200 HT

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 RIDGE VENTS (AT COVERED WALKWAY ROOF)

A. Flexible Ridge Vent: Owens-Corning standard, compression-resisting, three-dimensional, open-nylon or polyester mat filter bonded to a non-woven, non-wicking, geotextile fabric cover.

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. Owens-Corning

2.4 ACCESSORIES

A. Asphalt Roofing Cement; G: ASTM D 4586, Type II, asbestos free.

B. Roofing Adhesive: As recommended by manufacturer of synthetic roofing underlayment.

C. Roofing Nails: ASTM F 1667; stainless-steel or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- diameter, ring shank, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/2 inch through plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

D. Nails; Stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

A. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Single-Layer Synthetic Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch wide starter course at eaves and completely cover entire roof. Lap ends a minimum of 6 inches.

1. Apply a continuous layer of roofing adhesive over starter course and apply where and as noted for areas not covered by self-adhering sheet underlayment.
2. Install synthetic underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 4 inches in direction to shed water.
3. Terminate underlayment extended up not less than 4 inches against curbs and other roof projections.
4. Install fasteners at no more than 24 inch o.c. in field, unless otherwise required to meet specific wind load requirements.

C. Self-Adhering Sheet Underlayment: Install wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below and/or shown on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
2. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
3. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
4. Valleys: Extend from lowest to highest point 18 inches on each side.
5. Hips: Extend 18 inches on each side.
6. Sidewalls: Extend beyond sidewall 18 inches and return vertically against sidewall not less than 4 inches.
7. Dormers or Other Roof Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating elements not less than 4 inches.
8. Roof Slope Transition: Extend 18 inches on each roof slope.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.4 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed with self-sealing strip face up at roof edge.

1. Extend asphalt shingles flush with FHA drip edge at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install asphalt by single-strip column or racking method, maintaining uniform exposure. Install full length first course followed by cut second course, repeating alternating pattern in succeeding course.

E. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.

1. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.

2. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.

F. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.

3.5 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's area representative to inspect roofing installation on completion and submit report to Architect. Notify Architect and Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 07460

SIDING

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. Fiber-cement siding and trim.

B. Related Sections:

1. Section 06105 "Miscellaneous Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 061600 "Sheathing" for wall sheathing and weather-resistive barriers.
3. Section 06455 "Synthetic Wood Trim" for for exterior trim.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For siding including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- long-by-actual-width Sample of siding.
2. 12-inch- long-by-actual-width Samples of trim and accessories.

D. Product Certificates: For each type of siding, from manufacturer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

F. Research/Evaluation Reports: For each type of siding required, from Florida Building Code.

G. Maintenance Data: For each type of siding and related accessories to include in maintenance manuals.

H. Warranty: Sample of special warranty

1.4 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, from single source from single manufacturer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups for siding including accessories:

a. Size: 48 inches long by 60 inches high.
b. Include outside corner on one end of mockup and inside corner on other end.

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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.6 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.7 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and soffit that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking, deforming and fading.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING AND SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cemplank.
b. CertainTeed Corp.
c. James Hardie.
d. Maxi-Tile, Inc., a California corporation
e. Nichiha Fiber Cement

2. Horizontal Pattern: Boards 5-1/4 inches wide in style. Texture: Smooth.
3. Factory Priming: Manufacturer's standard acrylic primer
4. Soffit: Panels. Texture: Smooth.

2.2 ACCESSORIES

A. Flashing: Provide aluminum flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating, same color as siding.

B. Fasteners:

1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
2. For fastening fiber cement siding and soffit panels, use stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.

B. Install fiber-cement siding and soffit and related accessories. Install fasteners no more than 24 inches o.c.

C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074600

SECTION 07500

SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes labor, materials, and equipment to install the following roof system:

Insulation:

Bottom layer of polyisocyanurate, loose laid

Top layer of asphalt emulsion coated perlite coverboard mechanically fastened

Roofing Membrane

Two ply SBS modified bitumen roof system

Base layer of fiberglass reinforced SBS membrane, torched applied

Granulated cap layer of fiberglass reinforced SBS membrane, torched applied

1.02 REFERENCE STANDARDS

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards are deemed mandatory and applicable to the Work.

ASTM	American Society for Testing and Materials, Philadelphia, PA
NRCA	National Roofing Contractors Association, Rosemont, IL
FM	Factory Mutual Engineering and Research, Norwood, MA
UL	Underwriters Laboratories, Inc., Northbrook, IL
PIMA	Polyisocyanurate Insulation Manufacturers Association, Bethesda, MD
SMACNA VA	Sheet Metal and Air Conditioning National Contractor's Association, Chantilly,
OSHA	Occupational Safety and Health Administration, Washington, DC
SPRI	Single Ply Roofing Industry, Waltham, MA

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 "Terminology Relating to Roofing and Waterproofing"; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute Glossary of Roofing Terms for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Jobsite Safety: Execute all operations and provide a safe work environment in accordance to OSHA standards and regulations. This requirement applies to all contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.

Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.

Any applicable local fire codes supersede industry guidelines.

D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7-02.

E. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and/or FMG 4470 as part of a membrane roofing system and that are listed in FMG's "RoofNav" for Class 1 for noncombustible construction and Class A for exterior fire rating, as applicable. Identify materials with FMG markings.

F. UL Listing: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test methods mandated by UL. Identify materials with appropriate markings of applicable testing and inspecting agency.

G. Roofing membrane shall resist wind uplift forces per Drawing S-2.0.

1.05 SUBMITTALS

A. Submittals Package – General

Submit the Shop Drawings, Product Data, Samples, and Quality Control Submittals specified below at the same time as a package.

All submittal packages must be submitted prior to the Pre-Installation conference.

B. Product Data

Catalog sheets, Specifications and installation instructions for each material specified

Submit an intent to warrant, executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.

Manufacturer's Warranty: Submit a sample copy of the membrane manufacturer's warranty covering workmanship and materials.

C. Shop Drawings

When there is a proposed deviation from the Contract Documents, submit the revised detail labeled as such for approval. On the revised detail show existing conditions and referenced directly to the related details on the Contract Drawings.

D. Samples

All submitted samples must be labeled and supplied by manufacturer:

Roofing Membrane: One each type

Insulation: One each type

Coverboard: One each type

Fasteners: Three each type

1.06 QUALITY ASSURANCE

A. Certifications

Provide letter from the roofing membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of the insulation system.

B. Membrane Manufacturers Certifications:

Submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of five years.

Submit written certification that the manufacturer subscribes to a quality assurance process, or equivalent, in order to optimize product quality. Manufacturer must demonstrate and verify a defined Process Capability Potential (Cpk) program designed to ensure continuous improvement. A certificate of analysis of the quality assurance process will be mandatory upon the written request to the manufacturer from the owner's representative.

Roofing system manufacturer must provide inspection of guaranteed roofing systems by company employed, salaried, personnel dedicated to Technical Services.

Sales representatives or sales agents will not be permitted to conduct quality assurance inspections or grant final manufacturer’s acceptance.

C. Contractor's Certification:

Provide a letter from the membrane manufacturer certifying that the applicator is licensed or approved to install the roof system.

Provide names, address, and telephone numbers of five buildings where the applicator has installed similar roof systems that have the manufacturer’s guarantee issued. Include the types of systems installed, the manufacturer's name, and the guarantee numbers.

Letter certifying that the job foreman or crew chief and at least one other member of the roofing crew have installed at least similar systems and are thoroughly familiar with all aspects of the installation.

The Contractor shall provide a “final statement of compliance” to the Architect, which states that the finished roof membrane complies with the approved contractual documents per FBC Section 423.12.3”

The roof membrane shall be inspected by the manufacturer’s representative within one year of roof acceptance by the Board per FBC Section 423.12.4

D. Contractor’s Qualifications

Roofing Firm Qualifications:

Installation of a minimum of three roofs of comparable size, scope, and complexity as the roofing system specified in the Contract Documents, including all related sheet metal work, if applicable. (List two such jobs within 50 miles of the job site, including address, type of system and number of plies, if applicable, square footage, date installed and owner/agent with whom contracted).

In continuous operation of installing such roofing systems for five years or more.

E. Contract Closeout Submittals:

Final invoice for project

Close-out of any change orders

Final waivers of lien from all material suppliers and subcontractors

Completed punch list certification by Contractor and Owner's Representative

F. Preliminary Roofing Conference:

Before starting roof deck construction, conduct conference at Project site. Comply with requirements for pre-installation conferences in AIA Standard Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

Meet with Owner, Owner's Representative, Owner's insurer (if applicable), testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

Review means, methods, and procedures related to roofing installation, including manufacturer's written instructions.

Review Project Safety Plan for site conditions, enforcement, compliance, or Owner imposed restrictions that may be required.

Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

Examine site for approved staging areas, disposal sites, and document existing conditions prior to contractor mobilization. Establish scope of work for site restoration and responsibilities.

Examine site for condition and completion of areas adjacent to work area. Establish protection required for existing surfaces.

Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

Review structural loading limitations of roof deck during and after roofing operations.

Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

Review governing regulations and requirements for insurance and certificates if applicable.

Review temporary protection requirements for roofing system during and after installation.

Review work limitation by contractor including; start times, end times, days of the week, noise mitigation, fume control and any part of the work that would effect normal building operations.

Review trade coordination necessary for job completion.

Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, HANDLING & DISPOSAL

A. Delivery:

Deliver roofing materials to the site in the manufacturer's unbroken containers bearing the manufacturer's printed labels.

B. Storage and Handling

Rooftop storage will be permitted only with the authorization of architect

Do not point load roof.

Do not store any flammables on roof.

Store materials a minimum of 6" off the ground, in a dry, well ventilated place protected from the weather.

Temperature conditioned storage is required for temperature sensitive items.

Handle roll goods with care.

Do not use roll goods which have been damaged.

Leave materials in their packaging until ready for use.

Allow no unlabeled materials on site.

In event of damage, immediately make all repairs and replacements required by Owner's Representative.

C. Disposal

All removed materials become the property of the contractor.

Inspect ground areas surrounding roof on a daily basis for loose debris.

Immediately move all debris off roof and into approved dumpster.

Dumpster staging areas must be kept neat and tidy.

Do not allow to overflow.

All debris must be transported to a legal dumpsite or recycling facility and documentation of each load must be maintained by the Contractor.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to Manufacturer's written instructions and guarantee requirements.

Do not start roofing if rain is imminent, or ambient temperature is below 45°F.

If rain occurs during roof membrane application, cease operations and protect deck, insulation, penetrations and membrane from water damage and intrusion.

B. Flame-heated Equipment:

Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property.

Provide and maintain fire extinguisher.

C. Comply with all fire regulations. Ensure properly rated, charged, and inspected fire extinguishers are on the roof and staging area.

1.09 SUBSTITUTION

A. When a particular make or trade name is specified, it is indicative the standard required. The basis of this specification is a Johns Manville 2FID-HW.

B. For bidders proposing substitutes, submit the following ten (10) days prior to bid date to Owner's Representative:

Written request with explanation of why substitute product should be considered.

Manufacturer's literature and samples of requested substitutions.

Three (3) job references available for inspections within fifty (50) miles of Owner's Representative where substitutes were used under similar conditions.

Any methods or procedures that differ from this specification.

C. Only substitutes approved in writing by Owner/Owner's Representative prior to scheduled bid date will be considered.

1.10 WARRANTY

A. Manufacturer's Guarantee, without monetary limitation, includes materials and workmanship to maintain roof in a watertight condition.

Provide guarantee including membrane, insulation, fasteners, membrane flashings, and walkway pads.

Include expansion joint covers, liquid applied flashing, and metal edge products supplied by the manufacturer.

B. Provide manufacturer's system guarantee equal to Johns Manville's Fifteen (15) Year Peak Advantage No Dollar Limit Roofing System Guarantee. Guarantee to run from date of substantial completion. Manufacturer shall have a minimum AAA credit rating.

C. Applicator's guarantee:

Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, and walkway products, for a period of 2 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

Products: Subject to compliance with requirements, provide one of the products specified

2.02 MATERIALS

A. Thermal Layer

General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

Polyisocyanurate

Rigid roof insulation board composed of a closed cell polyisocyanurate foam core bonded in the foaming process to universal fiber glass reinforced facers. Provide to promote positive drainage.

Reference Standard

ASTM C 1289

Federal Specification HH-I-1972/Gen and HH-I-1972/2

CAN/ULC-S704-01, Type 3, Class 2 (See CCMC Evaluation Report 13058-L)

Product

ENRGY 3 – 3”

Typical Physical Properties

ASTM C 209, Water Absorption (% by Volume – 2 hours): 1 maximum

ASTM D 2126, Dimensional Stability Change (7 days @ 158°F (70°C), 90-100% RH)

Lengthwise: <2%

Crosswise: <2%

ASTM D 1621, Compression Resistance (10% Consolidation): 20 psi (138 kPa) nominal

ASTM C 209, Product Density – 2.0 pcf (32 kg/m3)

ASTM E 96, Moisture Vapor Transmission: <1 perm (57.5 ng/[Pa•s•m2])

Service Temperature: -100° to 250°F (-73° to 121°C)

B. Thermal Protective Layer

Perlite

A high density, low thermal rigid insulation board, composed primarily of expanded perlite with reinforcing cellulosic fibers and selected binders. The top surface is sealed with a special polymerized asphalt emulsion coating which allows for direct application of SBS or APP membranes using torch application techniques.

Reference Standard

ASTM C 728

Product

DuraBoard

Typical Physical Properties

Nominal Thickness: 1/2 inch

ASTM C209, Water Absorption (% Volume–2 hours): 3.5%

ASTM C 165, Compression Resistance:

5% Consolidation: 50 psi (345 kPa)

10% Consolidation: 85 psi (586 kPa)

ASTM C 209, Laminar Tensile Strength: 7 psi (48 kPa)

ASTM C 203, Flexural Strength: 90 psi (620 kPa)

ASTM C 209, Product Density: 10.0 pcf (160 kgs./m3) nominal

ASTM C 209, Linear Expansion: 0.5 % maximum

Thermal Protective Layer Securement

Mechanical

#12 Phillips or hex head fasteners with an engineered thread and corrosion-resistant coating, exceeding FM Global Approval Standard #4470 corrosion requirements. Provide with either a #3 Phillips head or a 1/4” hex head, a point designed for quick installation and 3” round, Galvalume metal plates.

Reference Standard

FM Global Approval Standard #4470

Product

UltraFast Fasteners and Plates

C. Membrane Layer

Base, Heat Weldable

A modified bitumen sheet incorporating a fiber glass mat with a blend of Styrene-Butadiene-Styrene rubber and asphalt with polyolefin burn-off film for heat welding on the back of the sheet.

Reference Standards

ASTM D 6163, Type I, Grade S

Product

DynaWeld 180 S Base

Typical Physical Properties

Thickness: 120 mils (3 mm)

Tensile Strength @ 0°F (-18°C)

Machine Direction: 100 lbs. force/in. width (17.5 kN/m)

Cross Machine Direction: 80 lbs. force/in. width (14.0 kN/m)

Elongation @ 0°F (-18°C)

Machine Direction: 45%

Cross Machine Direction: 45%

Tensile-Tear

Machine Direction: 100 lbs./in. (18.4 kN/m)

Cross Machine Direction: 80 lbs./in. (16.6 kN/m)

Low Temperature Flexibility : -10°F (-21°C)

Dimensional Stability

Machine Direction: 0.20% change

Cross Machine Direction: 0.20% change

Cap, Heat Weldable

A fire-resistant modified bitumen sheet incorporating a fiber glass mat with a blend of Styrene-Butadiene-Styrene rubber, asphalt and fire-retardant additives. Provide with a covering layer of ceramic-coated roofing granules and a back of the sheet that has a polyolefin burn-off film specifically for heat welding.

Reference Standard

ASTM D 6163, Type I, Grade G

Product

DynaWeld Cap FR CR

Typical Physical Properties

Thickness: 160 mils (4.0 mm)

Tensile Strength @ 0°F (-18°C)

Machine Direction: 135 lbs. force/in. width (23.6 kN/m)

Cross Machine Direction: 95 lbs. force/in. width (16.6 kN/m)

Elongation @ -0°F (-18°C)

Machine Direction: 4%

Cross Machine Direction: 4%

Tensile-Tear

Machine Direction: 125 lbs./in. (21.9 kN/m)

Cross Machine Direction: 100 lbs./in. (17.5 kN/m)

Low Temperature Flexibility: -10°F (-23°C)

Dimensional Stability

Machine Direction: 0.20% change

Cross Machine Direction: 0.20% change

D. Flashings

Modified Base Flashing Sheet

A modified bitumen sheet incorporating a fiber glass mat with a blend of Styrene-Butadiene-Styrene rubber and asphalt with polyolefin burn-off film for heat welding on the back of the sheet.

Reference Standards

ASTM D 6163, Type I, Grade S

Product

DynaWeld Base

Typical Physical Properties

Thickness: 120 mils (3 mm)

Tensile Strength @ 0°F (-18°C)

Machine Direction: 95 Ibs. force/in. width (16.6 kN/m)

Cross Machine Direction: 85 Ibs. force/in. width (14.9 kN/m)

Elongation @ 0°F (-18°C)

Machine Direction: 3.0%

Cross Machine Direction: 3.0%

Tensile-Tear

Machine Direction: 105 Ibs./in. (18.4 kN/m)

Cross Machine Direction: 95 Ibs./in. (16.6 kN/m)

Low Temperature Flexibility : -10°F (-21°C)

Dimensional Stability

Machine Direction: 0.20% change

Cross Machine Direction: 0.20% change

Modified Cap Flashing Sheet

A fire-resistant modified bitumen sheet incorporating a fiber glass mat with a blend of Styrene-Butadiene-Styrene rubber, asphalt and fire-retardant additives. Provide with a covering layer of ceramic-coated roofing granules and a back of the sheet that has a polyolefin burn-off film specifically for heat welding.

Reference Standard

ASTM D 6163, Type I, Grade G

Product

DynaWeld Cap FR CR

Paradiene 30 CR FR TG Cap Sheet by Siplast Roofing has been approved provided the insulation used meets what has been specified.

Typical Physical Properties

Thickness: 160 mils (4.0 mm)

Tensile Strength @ 0°F (-18°C)

Machine Direction: 135 lbs. force/in. width (23.6 kN/m)

Cross Machine Direction: 95 lbs. force/in. width (16.6 kN/m)

Elongation @ -0°F (-18°C)

Machine Direction: 4%

Cross Machine Direction: 4%

Tensile-Tear

Machine Direction: 125 lbs./in. (21.9 kN/m)

Cross Machine Direction: 100 lbs./in. (17.5 kN/m)

Low Temperature Flexibility: -10°F (-23°C)

Dimensional Stability

Machine Direction: 0.20% change

Cross Machine Direction: 0.20% change

Cant

Provide strip manufactured from a high density, laminated board made of high strength fibers and expanded perlite.

Reference Standard

ASTM C 728

Product

FesCant Plus

Typical Physical Properties

ASTM C 209, Water Absorption (% by Volume – 2 hours): 1.5 maximum

ASTM C 165, Compression Resistance:

5% Consolidation: 30 psi (207 kPa)

10% Consolidation: 40 psi (276 kPa)

ASTM C 209, Laminar Strength: 7 psi (48 kPa)

ASTM C 203, Flexural Strength: 65 psi (448 kPa)

ASTM C 209, Product Density: 9 pcf (144 kgs./m3)

ASTM C 209, Dimensional Stability: 0.5% maximum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that Work of other trades which penetrates the roof deck or requires personnel and equipment to traverse the roof deck has been completed.

B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent the execution, and quality of application, or the roofing system as specified.

Do not proceed with application of roofing system until defects are corrected.

3.02 PREPARATION

A. Surface Preparation

Inspect metal deck closely for:

Proper securement of panels to joists with no loose decking,

Differential deflection at side or end laps,

Side lap fasteners in place,

Damaged panels,

Corrosion.

Unacceptable panels should be brought to the attention of the General Contractor and Project Owner's Representative and must be corrected prior to installation of roofing system.

Ensure that wood blocking has been installed as detailed in the plans and specifications.

Make sure that all counterflashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8-inch base flashing height measured from the finished roof's surface to the top of the base flashing membrane.

3.03 INSTALLING THERMAL LAYER

A. Starting at the low edge of the roof, loose lay thermal layer board.

Install boards with long joints continuous.

Install with long joints running parallel to the decking.

Stagger short joints.

Butt joints tightly.

"Occasional" joint widths up to 1/4" will be allowed. Fill all any widths greater than 1/4" with scrap thermal layer to achieve consistent surface.

Use tapered insulation panels in areas requiring slope to achieve a minimum slope of 1/4 inch per foot, and where required to redirect drainage.

Use 1" thick boards to build-up the required thermal layer at the curved roof.

B. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.

Install only as much insulation as can be covered with roofing membrane the same day.

C. Repair any defects or installation errors prior to next phase of roof system installation.

3.04 INSTALLING THERMAL PROTECTIVE LAYER

A. Starting at the low edge of the roof, mechanically attach using fasteners approved for the specific project.

B. Starting at the low edge of the roof, mechanical fasten thermal layer board.

Install boards with long joints continuous.

Install with long joints running parallel to the decking.

Stagger short joints.

Butt joints tightly.

"Occasional" joint widths up to 1/4” will be allowed. Fill all any widths greater than 1/4” with scrap thermal layer to achieve consistent surface.

Use tapered insulation panels in areas requiring slope to achieve a minimum slope of 1/4 inch per foot, and where required to redirect drainage.

C. Fasten at density required to resist expected uplift pressures.

Increase fastener density at perimeters and corners in accordance with FM Global Property Loss Prevention Data Sheet 1-29.

Install fasteners no closer than 6 inches to the board edge.

Size fasteners for adequate penetration.

D. Keep insulation absolutely dry at all times. Discard insulation that contains moisture.

Install only as much insulation as can be covered with roofing membrane the same day.

E. Repair any defects or installation errors prior to next phase of roof system installation.

3.05 INSTALLING ROOFING MEMBRANE

A. Installation Summary

Membrane Installation Sequencing (from substrate to uppermost ply)

SBS modified, fiberglass, torchable base layer

SBS modified, fiberglass, granule surfaced torchable cap layer

Securement

Thermally activated adhesion, both layers

Install the membrane roofing strictly per the manufacturer’s printed technical instructions

B. Substrate

Verify that all requirements for examination and preparation have been met before commencing installation

C. Placing Membrane Layers

Start at low edge of the roof deck

Apply 1/2 width modified bitumen membrane

Apply all subsequent membrane sheets full width

End Laps: 6 inch minimum

Stagger end laps a minimum of 3 feet

Side Laps: 4 inch minimum

D. Securing Membrane

Install each layer of membrane so that it is firmly and uniformly set, without voids

Installation Precautions

Ensure even heating and application of membrane as not to damage inner reinforcements. Do not heat substrate under any circumstances.

Equipment

Accepted torch installation methods are with single-flame hand-held torch or multi-headed “dragon wagon”.

Fire Prevention

Fuel torches from acceptable propane tanks that are fueled and maintained by approved and licensed supplier of industrial gasses.

Observe all fire regulations and industry precautions. Provide one-hour fire watch at the end of each working session. Fire watch personnel may not be assigned to any other tasks during the one-hour period.

Provide CERTA training for all torch operators. Have training certificates available for inspection at any time during torch operations.

Installation Procedures

Keeping membrane in rolled form, position roll with side laps aligned

Using a propane torch, apply the flame to the surface of the coiled portion of the roll

Keep the flame directed at the adhered ply and in front of the roll

Torch across the full width of the roll and along the lap area

As the surface is heated, it will develop a sheen and the burn-off will disappear. (The generation of smoke is an indication that the material is being overheated)

Asphalt compound must bleed out past the edge of the sheet by a minimum ¼”

When membrane compound is prepared for adhesion, roll into position and ensure firm and uniform bearing

Repeat the operation with subsequent rolls, maintaining proper side laps and end laps

End Laps

Preparation of the end lap of the cap membrane layer requires scuffing away all loose granules.

Apply heat to the roll being seamed while making sure both have a good compound flow to adhere the two surfaces

Check end laps for proper adhesion

All new installed materials shall be sealed from moisture intrusion at the end of the day.

Quality Control

All laps must be checked with a round nose trowel to verify proper adhesion.

Entire roofing membrane must be installed at one time.

E. Cold Weather (below 50oF) application of Modified Bitumen

Modified bitumens require special application techniques when they are being installed in cold weather. The following precautions should be taken when the ambient temperature drops below 50°F (10°C), and are mandatory below 40°F (4°C):

Keep modified bitumen products warm, or warm prior to installation.

Store these materials indoors or in heated storage units or warming boxes. If these facilities are not available, placing the materials in direct sunlight may help.

Make certain that modified bitumen rolls are stored on end only; do not store rolls on their side.

When the conditions are extreme (below 40°F [4°C]):

Heat the rolls or completely unwind and allow to warm on the roof for 15 to 20 minutes.

Expose darker side of the sheet to the sunlight to allow to warm.

The sheet may then be installed using conventional application techniques.

3.06 INSTALLING FLASHINGS, ACCESSORIES

A. Temporary Flashings:

Provide a temporary waterproof seal at all membrane edges, penetrations, drains, etc. Unless complete flashings are installed immediately (same working day) following the membrane application.

B. Preparation:

Inspect walls, curb heights, counterflashings, etc., and check for conformance with minimum base flashing height of eight (8”).

Bring non-conforming areas to the attention of the Owner's Representative for correction.

C. Primer:

Prepare and prime substrate surfaces per manufacturer's instructions.

Follow manufacturer’s recommendations for required temperature of substrate and materials, and for filling of voids.

Prime all masonry, metal, or concrete surfaces from the top of the roof membrane to the termination of the flashing level with asphalt primer at the rate of one (1) gallon per 100 square feet or as recommended by the manufacturer.

Allow the primer to dry thoroughly.

Ensure that bonding surfaces to which the seal or flashing are to be placed are clean and free of moisture, dirt, grease, oil, loose material, foreign material, and debris.

D. Installing Flashings:

Flashings are critical to the success of the roofing system and flashing conditions vary. In addition to guidelines below, consult manufacturer for general flashing guidelines and project specific flashing design.

Provide seals or flashing at penetrations of the roof membrane as required for a watertight roof system, and as indicated on the Drawings, and as approved by the roof system manufacturer for inclusion in the roofing warranty.

Install two ply base flashing system using specified modified bitumen sheets at all intersections formed by changes of plane, and wherever curbed roof openings, wall, parapets, or other structure joint penetrates the roof.

Install flashing system using thermally activated adhesion.

Torch the back coating of each flashing sheet until the backer film disappears and the compound attains a sheen.

Place flashing with a firm and uniform bearing. Asphalt compound must bleed out past the edge of the sheet by a minimum ¼".

Use measures to prevent movement or migration of the flashing system while asphalt cures.

Add extra mechanical securement, where required.

E. Fluid-Applied Flashing System

Based on PermaFlash System. Follow manufacturer's instructions.

Lay out reinforcement fabric around penetration and cut to fit. Wrap fabric around penetration and bridge all vertical to horizontal transitions.

Apply fluid-applied flashing directly to prepared substrate. Adhere fabric by pressing into the fluid-applied flashing while still wet.

Completely cover fabric with at least 60 mil coat wet film thickness of fluid-applied flashing, and as required by the manufacturer.

Extend top coat of fluid-applied flashing system 2 inches beyond edges of reinforcement fabric.

3.07 FIELD QUALITY CONTROL

A. Test Strip (if requested by the Owner):

When and where directed by the Owner's Representative, and before surfacing is applied to the completed membrane:

Cut a strip 3" wide by 40" long thru all plies of the roofing system. Number of such test strips may be as required by the Representative.

After removal of the strip, immediately repair the area by applying the same number of plies of the same kind of felt and bitumen over the filled strip with the first ply.

Lap each edge 12" and each succeeding ply lapping the preceding ply by at least 3" on all edges.

Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.

Turn the test strips over to the Authority's Representative for examination.

If the test strips indicate the roofing system complies with the Specifications, the

B. Non-Compliance:

Failure of the bitumen samples or the test strip samples to meet the Specification requirements will be cause for rejection of the Work.

3.08 INSPECTION

A. After all roofing system Work is completed, provide an inspection by the roofing system manufacturer's representative. Representative must be employed expressly as a technical

employee and not concurrently function in a sales role. Provide, via the representative, documentation verifying that roofing system has been installed according to the Specifications.

3.09 CLEANING

A. Keep newly installed roofing membrane clean and new in appearance under the assumption that all areas of roofing are aesthetically essential. Contractor may be directed to remedy – and if no remedy available – replace, newly roofed areas that are not maintained as such during the balance of installation.

B. Restore all other building surfaces and areas affected by roofing application to same condition of aforementioned on day of job start.

C. Remove all debris from roof and staging areas.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

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. Manufactured Products:

a. Manufactured reglets and counter-flashing.

2. Formed Products:

a. Formed roof drainage sheet metal fabrications
b. Formed steep-slope roof sheet metal fabrications
c. Formed wall sheet metal fabrications
d. Formed equipment support flashing

B. Related Sections:

1. Division 06 Section “Miscellaneous Rough Carpentry" for wood nailers, curbs and blocking.
2. Division 07 Section “Roof Accessories” for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashings and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49

1. Where differences exist between FMG and ASCE-7 design data, the more restrictive criteria shall apply.

2. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.; 60-lbf/sq. ft. perimeter uplift force; 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.

3. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.; 90-lbf/sq. ft. perimeter uplift force; 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

4. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft.; 208-lbf/sq. ft. perimeter uplift force; 312-lbf/sq. ft. corner uplift force, and 104-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

E. Qualification Data: For qualified fabricator.

F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including fascia, fascia trim, and apron flashing, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Pre-Installation Conference: Conduct conference at project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim, including installers of roofing materials, roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and conditions of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel 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: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Surface: Smooth, flat
2. Exposed Coil-Coated Finishes:

a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Finish both sides of material where coil stock will be used to form products that will be exposed at both faces, such as gutters.

3. Concealed Finish: White as required to match with existing conditions.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.

1. Finish: 2D (dull, cold rolled).
2. Surface: Smooth, flat.

2.2 UNDERLAYMENT MATERIALS

A. Synthetic Roofing Underlayment: Minimum 12 mils thick consisting of slip-resisting polypropylene base sheet co-extruded on both sides with UV stabilized polyolefin.

1. Physical requirements of ASTM D 226 Type I and II
2. ASTM E 108 / UL 790 Class A fire classification
3. ICC-ES Legacy Report ER-5843 for roofing underlayment.
4. Miami-Dade County, FL – NOA No. 05-0329-01

B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20deg F
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft., rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item, unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and –welded corners, and junctions with interlocking counterflashing on an exterior face, of same metal as reglet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cheney Flashing Company
b. Fry Reglet Corporation
c. Heckmann Building Products, Inc.
d. Hickman, W.P. Company
e. Hohmann & Barnard, Inc., STF Sawtooth Flashing
f. Keystone Flashing Company, Inc.
g. National Sheet Metal Systems, Inc.
h. Sandell Manufacturing Co., Inc.

2. Material: Aluminum, 0.024” thick.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers and with channel for sealant at top edge.

4. Accessories:

a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

5. Finish: White.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Gutter Style: SMACNA designation Plate 2-K. See architectural drawings for profile.
2. Expansion Joints: Butt type with cover plate.
3. Gutters with Girth 21 to 25 inches: Fabricate from the following materials.

a. Aluminum: 0.050 inch thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts and anchors.

1. Fabricated Hanger Style: SMACNA figure designation Plate 35-A
2. Fabricate from the following materials:

a. Aluminum: 0.032 inch thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket and Backer Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick

B. Valley Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick

C. Drip Edge and Fascia: Fabricate in minimum 96-inch long but not exceeding 10-feet-long sections.

1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
2. Fabricate from the following materials:

a. Aluminum: 0.032 inch thick.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick

E. Copings: Fabricate in minimum 96-inch-long but not exceeding 10-foot long sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Coping Profile: SMACNA figure destination Plate 79-A
2. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
3. Fabricate from the following materials:

a. Aluminum: 0.050 inch thick.

F. Roof to Wall Transition, Roof to Edge Flashing (Shingle Stop) Transition, Roof to Roof Edge Flashing (Shingle Stop) and Fascia Cap Transition and Expansion Joint Cover: Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

G. Counterflashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

H. Flashing Receivers: Fabricate from the following materials

1. Aluminum: 0.032 inch thick.

I. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

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.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Install underlayment as indicated on drawings.

B. Synthetic Roofing Underlayment: Install synthetic sheet with mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 3-1/2 inches.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle-free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in a shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing 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.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4-inch for nails and not less than 3/4-inch for wood screws.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

G. Rivets: Rivet joints in uncoated aluminum and where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
4. Install gutter with expansion joints at locations indicated, but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Join sections with 1-1/2 inch telescoping joints.

1. Provide hangers with fasteners as shown or designated and designed to hold downspouts securely to walls. Locate hangers at top and bottoms and at approximately 60 inches o.c. in between.
2. Provide elbows and downspout adapters at base of downspouts to connect into new underground drainage system and direct water away from building.

D. Expansion Joint Covers: Install expansion joint covers at locations and configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous sheet anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone as indicated.

1. Interlock exterior bottom edge of copings with continuous cleats anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 20-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant and sealant interlocking folded seam.

F. Roof Penetration Flashing: Coordinate installation of roof penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets: Saw-cut reglets in concrete to receive flashings at exterior walls and roofing where flashing is shown at columns, and other conditions.

1. Fully dimension and detail full extent of reglet and flashing including all cutting and welding as required to flash around the round concrete columns.

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb and similar flashings to extend 4 inches beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07720

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. This Section includes the following:

1. Roof curbs.
2. Equipment supports.

B. Related Sections include the following:

1. Division 06 Section "Miscellaneous Rough Carpentry" for roof sheathing, wood cants and wood nailers.
2. Division 07 Section "Sheet Metal Flashing and Trim" for shop and field-fabricated metal flashing and counterflashing, roof expansion joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 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 noncorrosive installation.

1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes, roof expansion joints and roof access in general.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch thick.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

D. Self-Adhering High Temperature Sheet: Minimum 30 to 40 mils thick.

E. Synthetic Roof Underlayment: ASTM D 226, Type II (No. 30), non-perforated.

F. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

G. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

I. Elastomeric Sealant: ASTM C 920, polyurethane polysulfide or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

J. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation, and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Available Manufacturers:

    a. Colony Custom Curbs.
    b. Commodity Products Company, Inc.
    c. Conn-Fab Sales, Inc.
    d. Curbs Plus Inc.
    e. Custom Curb, Inc.
    f. LM Curbs.
    g. Loren Cook Company.
    h. Metallic Products Corporation.
    i. Pate Company (The).
    j. Roof Products & Systems Corporation.
    k. Roof Products, Inc.
    l. Thaler Metal Industries Ltd.
    m. ThyCurb; Div. of Thybar Corporation.
    n. Uni-Curb, Inc.
    o. Vent Products Company, Inc.

2. Material: Aluminum sheet, 0.090 inch thick.
3. Liner: Same material as curb, of manufacturer's standard thickness and finish.
4. Factory install wood nailers at tops of curbs.
5. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches unless otherwise indicated.

2.5 PREFORMED FLASHINGS

A. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted or perforated metal collar, and as follows:

1. Available Manufacturers:

    a. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.064 inch thick.
3. Diameter: As indicated

B. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, uninsulated, and as follows:

1. Manufacturers:

    a. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.
3. Height: 7 inches

4. Diameter: As indicated.

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 work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of self-adhering underlayment and cover with a slip sheet, or install a course of self-adhering underlayment if located in zones required to have a self-adhering membrane.
3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:

1. Set roof curb so top surface of roof curb is level.

F. Roof Hatch Installation:

1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.

G. Preformed Roof Penetration Flashing Installation: Secure to roof membrane according to vent and stack flashing manufacturer's written instructions.

H. Seal joints with Elastomeric or butyl sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Polyurethane joint sealants.

B. Related Sections:

1. Division 04 Section “Unit Masonry” for masonry control and expansion joint fillers and gaskets.
2. Division 06 Section “Synthetic Wood Trim”
3. Division 09 Section “Gypsum Board” for sealing perimeter joints.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 or manufacturer’s standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer’s written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required of joint sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to 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 indicated.
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 per Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C1521.

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.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. 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.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

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.

E. Qualification Data: For qualified installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

G. Preconstruction Compatibility and Adhesion 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 needed for adhesion.

H. Preconstruction Field-Adhesion Test Reports: Indicated which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on tseting specified in Preconstruction Testing article above.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to received joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Pre-Installation Conference: Conduct conference at Project Site.

1.5 PROJECT 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 degrees 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.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which 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: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 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 structure resulting in stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural 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 MATERIALS, 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. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 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 per

ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing per ASTM C1248 and have not stained porous joint substrates indicated for Project.

D. 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.

E. Colors of Exposed Joint Sealants: Selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the work include but are not limited the following:

a. Dow Corning Corporation
b. GE Advanced Materials – Silicones, SilPruf LM SCS2700
c. May National Associates
d. Pecora Corporation
e. Sika Corporation, Construction Products Division; SikaSil-C990
f. Tremco Incorporated.

B. Mildew-Resistant, Single-Component, Nonsag, Neutral Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation 898

2.3 URETHANE JOINT SEALANTS

A. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Subject to compliance with requirements, available products that may be incorporated into the work include but are not limited the following:

a. BASF Building Systems
b. Bostik, Inc.
c. May National Associates
d. Pacific Polymers International, Inc.
e. Pecora Corporation
f. Polymeric Systems, Inc.
g. Schnee-Morehead, Inc.
h. Sika Corporation, Construction Products Division
i. Tremco Incorporated

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bi-cellular material with surface skin) or any of the preceding types as approved in writing by joint sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.5 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: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

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 joint sealant performance.

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 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), existing 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

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 C1193 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. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants per 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.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193
5. Provide recessed joint configuration of recess depth and at locations indicated in Figure 8C in ASTM C 1193.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08111

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fully galvanized standard hollow metal doors and frames for replacement of existing exterior doors and frames.
2. Hardware for new doors is included in this section and Section 08710, Finish Hardware

B. Related Sections:

1. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.
B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Provide with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steelcraft, an Ingersoll-Rand Company (existing doors and basis of design).
2. Architectural Openings, Inc.
3. Amweld Building Products, LLC.
4. Ceco Door Products; an Assa Abloy Group company.
5. Curries Company; an Assa Abloy Group company.
6. Habersham Metal Products Company
7. Pioneer Industries
8. Security Metal Products Corp.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./BTU when tested according to ASTM C 1363

3. Vertical Edges for Single-Acting Doors: Manufacturer’s standard.

a. Beveled Edge: 1/8 inch in 2 inches.

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
2. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless)

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: minimum 14 gauge 0.067-inch- thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Post-Installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites and transoms where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 HARDWARE

A. Refer to Division 08 Section “Finish Hardware” for hardware requirements and schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
3. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4-inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

E. Hardware: Install in accordance with manufacturer's instructions and as approved by the Owner's locksmith.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefit and pre-machined wood doors.
2. Prefinished wood doors.

B. Related Sections:

1. Section 06105 – Miscellaneous Rough Carpentry.
2. Section 06201 – Exterior Finish Carpentry
3. Section 06402 – Interior Architectural Woodwork
4. Section 08111 - Hollow Metal Doors and Frames.
5. Section 08710 - Hardware.
6. Section 08800 - Glazing: Glass and glazing for doors.
7. Section 10200 – Louvers and Vents

1.2 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit in accordance with Section 01330.
2. Indicate general construction, jointing methods, hardware and louver locations, and locations of cut-outs for glass. Indicate thickness of veneers.

B. Samples:

1. Submit samples of wood veneer and factory finishing in accordance with ANSI/WDMA Quality Standards I.S. 1-A 1997, sections G-18 and Guide Specifications 1.03 C.

C. Certification:

1. Submit certification that doors and frames comply with UBC 7-2 1997or UL10c, Positive Pressure Fire Door Test Method.

1.3 PRODUCT HANDLING

A. Plastic wrap and protect wood doors during transit, storage and handling to prevent damage, soiling or deterioration. Follow the Care and Installation guidelines as described in ANSI/WDMA I.S. 1-A 1997.

B. Upon acceptance on site inspect for damage, do not store in damp wet areas, HVAC system should be operating and balanced prior to arrival of the doors, and have acceptable humidity conditions ranging from 25% to 50% relative humidity.

1.4 GUARANTEE/WARRANTY

A. Guarantee: Provide manufacturer's guarantee for all wood doors. Guarantee period: Lifetime of original installation. Doors exhibiting defects in materials or workmanship within guarantee period shall be replaced (including hanging and finishing) with new doors. These terms shall be part of the manufacturer's standard warranty.

PART 2 PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

A. GRAHAM Manufacturing

B. Eggers Industries

C. Algoma Hardwoods

2.1 MATERIALS

A. Door Construction:

1. Non-Fire Rated Doors: SLC-5 or SCL-5; Thickness: 1-3/4 inches, interior flush wood, bonded, staved lumber core conforming to ANSI/WDMA I.S. 1-A 1997 and the following;

   a. Core: bonded, Staved Lumber Core (SLC) conforming to ANSI/WDMA I.S. 1-A 1997.
   b. Door construction shall conform to ANSI/WDMA I.S. 1-A 1997 Premium Grade requirements.
   c. Stiles: Hardwood or veneer edge banded to match face veneer over Structural Composite Lumber backers (SCL), glued to core.
   d. Rails: Mill option hardwood or SCL. Top and bottom.
   e. Facing: Wood veneer cut and specie as specified shall conform to ANSI/WDMA I.S. 1-A 1997 "A" grade for Premium Grade Door Construction requirements.

B. WOOD VENEER

1. Door face veneers shall meet quality standards conforming to ANSI/WDMA I.S. 1-A 1997 "A" grade. Minimum face veneer thickness shall be 1/50" at 12% moisture content after finish sanding
2. Species: Select Red Oak
3. Face Cut: Plain Sliced
4. Face Assembly: Book Match
5. Face Symmetry: Running Match

C. ADHESIVES

1. Adhesives: Face to core adhesives shall be Type I or Type II as appropriate for location in building. Adhesives must be classified Type I or Type II per WDMA TM-6 "Adhesive Bond Test Method." Type I adhesives shall be used for doors in exterior applications, Type II adhesives shall be used for doors in interior applications.

D. CORE

1. Non-rated and 20 minute doors: Staved lumbercore or structural composite lumber.
2. Fire-rated doors: Non-combustible fire resistive core containing no asbestos.

2.2 STC - SOUND RATED ACOUSTICAL WOOD DOORS

A. Faces and grade shall match non-rated and fire rated doors.

B. The sound transmission class specified shall be certified by the manufacturer to be based on tests conducted at an independent testing agency in accordance with ASTM E90-90.

C. Design of STC Doors are based on STC-30 flush door construction.

D. Provide gasketing systems necessary to achieve STC ratings. This is to include but not limited to, sound seal, door bottoms and thresholds as required.

2.3 FACTORY FINISHING

A. Comply with referenced WDMA Section G-15, “Factory Finishing” for Premium Grade factory finish systems.

B. Pre-finish wood doors at factory.

C. Transparent Finish: Match finish indicated in WDMA Section G-17: WDMA System #6. Submit sample of transparent finish for selection by Architect.

2.4 ACCESSORIES

A. Vision Frames:

1. Non-rated doors: Flush wood frames, hardwood to match face veneer.

2.5 FABRICATION

A. Fabricate wood doors in accordance with requirements of ANSI/WDMA I.S. 1-A 1997 Quality Standards.

B. Fabricate non-fire rated and fire rated doors with WDMA Quality Standards hardware blocking options. Appropriate blocking shall be included for all doors to receive both surface mounted and mortised hardware, the use of thru bolts will not be accepted.

C. Make cut-outs and provide stops for glass and louvers. Install metal door louvers. Seal cut-outs prior to installation of moldings.

1. For full light doors: Provide cut out from flush wood door, with vertical grain direction.

D. Bevel lock and hinge edges of single acting doors 3 degrees or 1/8 inch in 2 inches. Radius strike edge of double acting swing doors as required by pivot hinge manufacturer.

PART 3 EXECUTION

3.0 EXAMINATION

A. Examine installed door frames before hanging doors.

B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.1 INSTALLATION

A. Handle doors in accordance with recommendations of ANSI/WDMA I.S. 1-A, “Care and Installation at Job Site.”

B. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation. Store doors per recommendations of ANSI/WDMA I.S. 1-A, “Care and Installation at Job Site.”

C. Install in neat and workmanlike manner, free from hammer or tool marks, open joints or slivers.

D. Set plumb, level, square and true. Install work after building humidity is at acceptable level.

E. Remove and replace all doors found to be warped, twisted, bowed, or otherwise damaged. Do not install doors which cannot be properly fitted to frames.

F. Adjust prefinished doors and hardware and other moving or operating parts to function smoothly and correctly.

G. If doors are to be field finished, the process must follow the ANSI/WDMA I.S. 1-A, “Care and Handling at Job Site” instructions for field applied finishes.

H. Ensure that smoke gaskets are in-place before prefinished door installation.

3.2 CLEANING / PROTECTION

A. Clean prefinished doors and hardware.

B. At clear finished doors, do not partially cover door surfaces with paper, cardboard, or any other opaque covering that will create uneven aging of wood veneer.

C. Protect doors as directed under Section 01700.

D. Refinish or replace finished doors damaged during installation.

END OF SECTION

SECTION 08331

ROLLING DOOR (FIRE-RATED)

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The opening will be equipped with an electric-operated, fire-rated rolling door.

B. Rolling door shall be “FireStar” 700 Series as manufactured by Wayne-Dalton, or an approved equal.

1.2 RELATED WORK

A. Opening preparation, miscellaneous and structural metal work, access panels, finish or field painting, field electrical wiring, wire, conduit, fuses, and disconnect switches are in the Scope of Work of other divisions or trades.

1.3 REFERENCE STANDARDS

A. ANSI/DASMA 204 American National Standards Institute Specifications for rated fire rolling doors published by Door & Access Systems Manufacturers Association International.

B. ASTM A123 Zinc [hot-dipped galvanized] coatings on iron and steel products.

C. ASTM A229 Steel wire, oil-tempered for mechanical springs.

D. ASTM A-653-94 Steel sheet, zinc-coated [galvanized] by the hot-dipped process, commercial quality.

E. UL10B Underwriters Laboratories (UL) Fire Tests of Door Assemblies.

F. NFPA 80 National Fire Protection Agency Fire Doors and Other Opening Protectives.

1.4 QUALITY ASSURANCE

A. Rolling doors and all accessories and components required for complete and secure installations shall be manufactured as a system from one manufacturer.

1.5 SYSTEMS DESCRIPTION

A. Rolling Door: Type: Model 700

B. Mounting: Steel and masonry jambs

C. Operation: Motor with chain hoist

D. Material: Galvanized steel with polyester finish paint.

1.6 SUBMITTALS

A. Shop Drawings: Clearly indicate the following:

1. All details required for complete operation and installation.

2. Hardware locations.

3. Type of metal and finish for door sections.

4. Finish for miscellaneous components and accessories.

B. Product Data: Indicating manufacturer's product data, and installation instructions.

1.7 DELIVERY, HANDLING, STORAGE

A. Deliver products in manufacturers original containers, dry, undamaged, seals and labels intact.

B. Store and protect products in accordance with manufacturer's recommendations.

1.8 WARRANTY

A. Standard manufacturers one year warranty against defects in material and workmanship.

PART 2 – PRODUCTS

2.1 CURTAIN

A. Curtain will be composed of interlocking flat slats, 18 gauge galvanized steel, roll-formed per ASTM standards. Ends of alternate slats will be fitted with metal endlocks.

B. Bottom Bar will consist of two equal steel angles, .121" minimum thickness, to stiffen curtain, with optional astragal. Provide cylinder locks on the bottom bar operable from coil side.

2.2 GUIDES

A. Guides will be roll-formed steel structural grade, three angle assembly of steel to form a slot of sufficient depth to retain curtains in guides and to allow expansion at all bolt connections. Provide brush seals to reduce smoke/air infiltration around door opening.

2.3 BRACKETS

A. Brackets will be of 3/16" minimum thick steel plates, with permanently sealed ball bearings. Designed to enclose ends of coil and provide support for counterbalance pipe at each end.

2.4 COUNTERBALANCE

A. Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed .033" per foot of door span and to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs will be used to anchor springs to tension shaft and pipe.

2.5 HOOD

A. Hood will be minimum 24-gauge galvanized sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Hood will enclose curtain coil and counterbalance mechanism. Hoods shall be furnished with a steel hood baffle.

2.6 FINISH

A. Shop coat of rust inhibitive primer on non-galvanized surfaces and operating mechanisms. Guides and bracket plates will be coated with a flat black prime paint. Curtain color will be selected by Architect from powder coating 180 available colors.

2.7 OPERATION

A. Door will be operated by means of motor operation]. Provide electrical sensing edge attached to bottom bar to stop and reverse the door when it contacts an object during the closing cycle.

2.8 RELEASE MECHANISM

A. Doors will be equipped with FireStar release mechanism, requiring only one cable to be routed to the operated side (cable not required to be routed to adjusting wheel side.) Doors will close by a thermally actuated link rated at 165 degrees F, or by an optional listed releasing device, or by manually operating the release handle. All spring tension shall be maintained when the release mechanism is activated. After closing by manual operation of release handle, the door shall be able to be reset by one person from one side of the door (re-engaging the release handle).

2.9 GOVERNOR

A. If required by the size of the door, a viscous governor will be furnished to regulate the rate of descent of the door in a quiet manner. It will be the engagement type which is not engaged during normal door operation, but which after cable release, will retard the speed during automatic door closure to under 2 per second and not less than 6" per second.

2.10 LABELS

A. Rolling fire doors will bear the 1-1/2 (one and one-half) hour label. Rolling fire doors will be manufactured in strict accordance with the requirements of Underwriters Laboratories-listed procedures or Factory Mutual-approved procedures, and will bear the UL label.

2.11 LOCKING

A. Electric-motor operation doors will lock through the operator gearing. Cylinder locks will be provided with the doors.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

1. Install the rolling fire doors in accordance with manufacturer's instructions and standards and in accordance with the standards of the National Fire Protection Association Standard 80 (NFPA 80). Installation and annual maintenance will only be by a trained door systems technician.

2. Verify that existing conditions are ready to receive rolling door work.

3. Beginning of rolling door work means acceptance of existing conditions.

B. Fit, align, and adjust rolling door assemblies level and plumb for smooth operation.

C. Upon completion of final installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting for entire perimeter.

3.2 TESTING

A. Rolling steel fire doors will be drop-tested in accordance with NFPA 80 and witnessed, attesting to their successful operation at the time of installation.

3.3 MAINTENANCE

A. Per NFPA 80, paragraph 15-2 4.3: All horizontal or vertical sliding and rolling fire doors shall be inspected and tested annually to check for proper operation and full closure. Resetting of the release mechanism shall be done in accordance with the manufacturer's instructions. A written record shall be maintained by the building owner and made available to the authority having jurisdiction.

END OF SECTION

SECTION 08410

ALUMINUM ENTRANCES & STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of aluminum entrance and storefront work:

1. Exterior entrance door.
2. Frames for entrances.
3. Exterior storefront-type glazed framing system and storefront-type glazed interior framing system.
4. Interior view windows
5. Frames for exterior wall panels
6. Composition panels

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Glazing requirements for aluminum entrances and storefronts, including entrances specified to be factory glazed, are included in Division 8 Section "Glass and Glazing".

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide exterior aluminum entrance and storefront assemblies that comply with performance characteristics specified, as demonstrated by testing the manufacturer's corresponding stock assemblies according to test methods indicated.

B. Thermal Movement: Design the aluminum entrance and storefront framing systems to provide for expansion and contraction of the component materials. Entrance doors shall function normally over the specified temperature range.

1. The system shall be capable of withstanding a metal surface temperature range of 180 degrees F (100 degrees C) without buckling, failure of joint seals, undue stress on structural elements, damaging loads in fasteners, reduction of performance, stress on glass, or other detrimental effects.

C. Design Requirements: Provide aluminum entrance and storefront systems that comply with performance, air infiltration, and water penetration requirements indicated.

a. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind load design calculated according to requirements of authorities having jurisdiction of the American Society of Civil Engineers' ASCE 7 "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

b. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or ¾", whichever is smaller, unless otherwise indicated.

c. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

1) Test Pressure: 150 percent of inward and outward wind-load design pressures.

2) Duration: As required by wind velocity; fastest 1 mile of wind for relevant exposure category.

2. Dead Loads: Provide entrance and storefront system members that do not deflect an amount which will reduce glazing bite below 75% of design dimension when carrying full dead load.

a. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.

b. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

3. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

4. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air pressure difference of 1.57 lbf/sq. ft.

5. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 10% of inward-acting wind-load design pressure as defined by ASCE 7 "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:

a. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

6. Products and materials shall be approved to meet the design wind criteria of 120 mph with an importance factor of 1.15 per ASCE 7-05.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division Specification Sections:

1. Product data for each aluminum entrance and storefront system required, including:

a. Manufacturer's standard details and fabrication methods.
b. Data on finishing, hardware, and accessories.
c. Recommendations for maintenance and cleaning of exterior surfaces.

2. Shop drawings for each aluminum entrance and storefront system required.
3. Hardware Schedule: Submit complete hardware schedule.
4. Samples for Initial Color Selection: Submit pairs of samples of each specified color and finish.
5. Test Reports: Provide certified test reports from a qualified independent testing laboratory showing that aluminum entrance and storefront systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installations of aluminum storefront and entrances similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer's Qualifications: Provide aluminum entrances and storefront systems produced by a firm experienced in manufacturing systems that are similar to those indicated for this project and that have a record of successful in-service performance.

C. Single-Source Responsibility: Obtain aluminum entrance and storefront systems from one source and from a single manufacturer.

D. Design Criteria: The drawings indicate the size, profile, and dimensional requirements of aluminum entrance and storefront work required and are based on the specific types and models indicated. Aluminum entrance and storefront by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum entrance and storefront components in the manufacturer's original protective packaging.

1.7 WARRANTY

A. Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period.

B. Warranty Period: 3 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The Basis-Of-Design of the section is Kawneer Tri-Fab 451 for exterior storefront and Kawneer Tri-Fab 400 for interior storefront. Subject to compliance with requirements, design intent and these specifications provide the named product or a comparable product by one of the following:

1. Alumiglass, Inc.
2. Vistawall Architectural Products
3. YKK AP Architectural Products.

2.2 MATERIALS

A. Aluminum Members: Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for aluminum extrusions, ASTM B 209 for aluminum sheet or plate, and ASTM B 211 for aluminum bars, rods, and wire.

B. Carbon steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates, and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

C. Glass and Glazing Materials: Comply with requirements of "Glass and Glazing" section of these specifications.

D. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be non-corrosive and compatible with aluminum components, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125 inches thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard non-corrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match finish of member or hardware being fastened.

E. Concealed Flashing: 0.0179 inch (26 gage) minimum dead-soft stainless steel, or 0.026 inch thick minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other requirements.

F. Brackets and Reinforcements: Provide high-strength aluminum brackets and reinforcements; where use of aluminum is not feasible, provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

G. Concrete and Masonry Inserts: Provide cast-iron, malleable iron, or hot-dip galvanized steel inserts complying with ASTM A 123.

H. Sliding Weatherstripping: Manufacturer's standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2

2.3 HARDWARE

A. General: Refer to Division 8 Section "Finish Hardware" for requirements for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.

B. Provide heavy duty hardware units as indicated, scheduled or required for operation of each door, including the following items of sizes, number, and type recommended by manufacturer for service required; finish to match door.

1. Ball-Bearing Butts: 5-knuckle, 2-bearings, steel ball bearing butts to comply with ANSI A156.1, Grade 1.
2. Surface-Mounted Overhead Closers: Modern type with cover, for hinge side installation. Comply with ANSI A156.4, Grade 1. Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather and anticipated frequency of use. Include the following:

    a. Door Stop: Floor- or wall-mounted door stop, as appropriate, with integral rubber bumper; comply with ANSI A156.1, Grade 1.

3. Cylinders are supplied under another Division 8 Section for keying into the building system.
4. Pull Handles: Aluminum pull handles of style indicated, similar to Kawneer "CO-12".
5. Thresholds: Extruded aluminum threshold of size and design indicated in mill finish, complete with anchors and clips, coordinated with pivots and floor-concealed closers.
6. Panic Hardware: Panic cross bars with concealed rods and panic lock cylinder at Door No's. 1, 2, 36 and 37. Similar to Kawneer No. 1686 or Dur-O-matic/Falcon No. 1690.

2.4 COMPONENTS

A. Basis of Design: Kawneer Tri-Fab 451. Provide manufacturer's standard 1-¾" thick glazed doors with minimum 0.125" thick, extruded tubular rail and stile members similar to the Basis of Design. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
2. Stile Design: 350 medium stile.
3. Glazing details: 2" x 4-1/2" glazing frame section

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.

2.5 FABRICATION

A. General: Fabricate aluminum entrance and storefront components to designs, sizes, and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the drawings. Variable dimensions are indicated, with maximum and minimum dimensions required, to achieve design requirements and coordination with other work.

B. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.

1. Perform fabrication operations including cutting, fitting, forming, drilling, and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.

2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.

3. Preglaze door and frame units to greatest extent possible.

C. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.

1. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.

D. Storefront: The framing system shall [provide for flush glazing on all sides with no projecting stops. Exterior vertical and horizontal framing members shall have a nominal face dimension of 2". Overall depth shall be 4-1/2". Interior framing system shall be 1-3/4" x 4" depth. Entrance framing members shall be compatible with glass framing in appearance. All single acting entrance frames shall include the positive barrier weathering.

1. Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

E. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weatherstripping at fixed stops. At other locations, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

F. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.

G. Dissimilar Metals: Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.

H. Continuity: Maintain accurate relation of planes and angles with hairline fit of connecting members.

1. Uniformity of Metal Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.

I. Fasteners: Conceal fasteners wherever possible.

J. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops. At other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

1. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

2.6 FINISHES

A. General: Comply with NAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Finish of aluminum entrance framing, entrance doors and storefront windows shall be a 70% Kynar painted finish with the color to be selected by the Architect from Kawneer's No.22 standard painted finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and supports, with the Installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of aluminum entrances and storefronts. Correct unsatisfactory conditions before proceeding with the installation.

1. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation.

B. Set units plumb, level and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and elation to established grades and lines indicated. Provide proper support and anchor securely in place.

C. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

1. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.

2. Paint dissimilar metals where drainage from them passes over aluminum.

3. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating.

4. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with two coats of aluminum house paint. Seal joints between the materials with sealant.

D. Drill and tap frame and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

E. Set still members and other members in bed of sealant as indicated, or with joint filler or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.

3.3 ADJUSTING

A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3.4 CLEANING

A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

B. Clean glass surfaces after installation. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

END OF SECTION

SECTION 08521

ALUMINUM-CLAD WOOD DOUBLE-HUNG WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Aluminum-clad wood double-hung windows.

1. Pre-finished interior and exterior

1.3 RELATED SECTIONS

A. Section 07920 Joint Sealants: Sealants and caulking.

1.4 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):

1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
2. ASTM C 1036 - Flat Glass.
3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
6. ASTM D 3656 – Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
8. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
11. ASTM G 85 - Modified Salt Spray (Fog) Testing.

C. Screen Manufacturer's Association (SMA):

1. SMA 1201 – Specifications for Insect Screens for Windows

1.5 PERFORMANCE REQUIREMENTS

A. Windows shall be Hallmark certified to a rating of LC-45 specifications in accordance with ANSI/AAMA/NWWDA I.S.2

B. Window Unit Air Leakage, ASTM E 283, 6.24 psf (50 mph): 0.05 cfm per square foot of frame or less.

C. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 15 psf (77 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.6 SUBMITTALS

A. Comply with Division 1 requirements.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.

E. Warranty: Submit manufacturer's standard warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.

B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.

C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The existing windows are Pella and new windows shall match exterior profile and sight lines. In order to maintain the appearance of the existing windows, a proprietary specification is written to address these issues.

1. Other manufacturers may request to be included as a substitution in accordance with Section 01600 Materials and Equipment.
2. All requests for substitution shall be presented by a General Contractor.
3. Requests from manufacturers will not be considered.

B. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website: http://www.pella.com

2.2 ALUMINUM-CLAD WOOD DOUBLE-HUNG WINDOWS

A. Aluminum-Clad Wood Double-Hung Windows: Architect Series, factory-assembled, aluminum-clad wood double-hung windows. Sash shall tilt to interior without removal for cleaning.

B. Frame:

1. Select softwood, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.4. EnduraGuard® includes water-repellency, three active fungicides and an insecticide applied to the frame.
2. Interior Exposed Surfaces: Clear pine with no visible fastener holes

a. Factory pre-finished white.

3. Exterior Surfaces: Clad with aluminum.
4. Overall Frame Depth: 5 inches.

C. Sash:

1. Select softwood, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.4. EnduraGuard® includes water-repellency, three active fungicides and an insecticide applied to the sash.
2. Interior Exposed Surfaces: Clear pine with no visible fastener holes

a. Factory pre-finished white.

3. Exterior Surfaces: Clad with aluminum, lap-jointed at corners.
4. Corners: Mortised and tenoned, glued and secured with metal fasteners.
5. Sash Thickness: 1-3/4 inches.

D. Weatherstripping:

1. Water-stop santoprene wrapped foam at head and sill.
2. Thermal-plastic elastomer bulb with slip coating set into lower sash for tight contact at checkrail.
3. Vinyl-wrapped foam inserted into jamb liner or jamb liner components to seal sides of sash.

2.3 GLAZING

A. Glazing:

1. Float Glass: ASTM C 1036, Quality 1. Tinted Solar Grey to match existing.
2. Type: Silicone-glazed 5/8-inch dual-seal, annealed, insulating glass, multi-layer Low-E coated with argon.

a. All glazing within four feet of a door shall be tempered in accordance with Florida Building Code.

3. Integral Light Technology Glazing and Grilles:

a. Insulating glass contains non-glare grid between two panes of glass.
b. Non-glare Grid: Adhered to glass
c. Room Side Grilles: Solid 7/8-inch wide Clear Pine; pre-finished white.
d. Exterior Grilles: Extruded aluminum. Dimension to match room side grilles.
e. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with foam grid.
f. Finish: Exterior surfaces finished to match window cladding. Interior surfaces prefinished, white.

B. Insect Screens: Standard, full.

1. Compliance: ASTM D 3656 and SMA 1201
2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
3. Set in aluminum frame fitted to inside
4. Complete with necessary hardware.
5. Screen Frame Finish: Baked enamel.

2.4 HARDWARE

A. Balances:

1. Block-and-tackle balances
2. Balances are attached to frame and connected with polyester cord.

B. Tilt Hardware: Steady-tilt, self-supporting, tilt-wash feature on lower sash.

C. Locking System:

1. Spoon-shaped sash lock.
2. One installed on units with frame width less than 37 inches, 2 locks on installed units with frame width of 37 inches or greater.

D. Sash Lifts:

1. Sash lift furnished for field installation.
2. Two sash lifts on units with frame width of 37 inches or greater.

E. Lock and Sash Lift Finish: Baked enamel, white.

2.5 TOLERANCES

A. Windows shall accommodate the following opening tolerances:

1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

2.6 FINISH

A. Exterior Finish System: Pella EnduraClad.

1. Exterior extruded aluminum surfaces shall be finished with the following multi-stage system:

a. Clean and etch aluminum surface of oxides.
b. Pre-treat with chrome phosphate conversion coating.
c. Pre-treat with chromic acid sealer/rinse.
d. Top coat with baked-on polyester enamel.

2. Color: Pella White

3. Performance Requirements: Exterior aluminum finishes shall meet or exceed the following performance requirements of AAMA 2605:

a. Dry Film Hardness: Eagle Turquoise Pencil, F minimum.
b. Film Adhesion: 1/16-inch crosshatch, dry, wet, boiling water.
c. Impact Resistance: 1/10-inch distortion, no film removal.
d. Abrasion Resistance: Falling sand coefficient value of 20 minimum.
e. Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24 hours.
f. Detergent Resistance: 3 percent at 100 degrees F, 72 hours.
g. Corrosion Resistance: Humidity, 3,000 hours. Salt spray exceeds 3,000 hours.

B. Exterior Finish System Performance Requirements: Pella EnduraClad.

1. Exterior aluminum finishes shall meet or exceed following performance requirements:

a. Ozone Deterioration, ASTM D 1149, Modified: 5 ppm ozone, 160 degrees F, 60 percent relative humidity, 100 hours exposure, little or no loss of cure.

b. Filiform Corrosion Resistance of Organic Coatings on Metal, ASTM D 2803: No corrosion.
c. Taber Abrasion Resistance, ASTM D 4060: 500 g weight, CS-10 wheel, 500 cycles, less than 25 g weight loss.
d. Cyclic Acidified Salt Fog Test, ASTM G 85, Appendix A-2.

C. Interior Finish: Prefinished, white.

2.7 INSTALLATION ACCESSORIES

A. Flashing/Sealant Tape: Pella SmartFlash.

1. Aluminum-foil-backed butyl window and door flashing tape.
2. Maximum Total Thickness: 0.013 inch.
3. UV resistant.

B. Insulating-Foam Sealant: Dow Great Stuff Window & Door.

1. Low-pressure, polyurethane window and door insulating-foam sealant.

2.8 SOURCE QUALITY CONTROL

A. Factory Testing: Factory test individual standard operable windows for air infiltration in accordance with ASTM E 283 to ensure compliance with this specification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install windows in accordance with manufacturer's instructions and approved shop drawings.

B. Install windows to be weather-tight and freely operating.

C. Maintain alignment with adjacent work.

D. Secure assembly to framed openings, plumb and square, without distortion.

E. Integrate window system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with window manufacturer's instructions.

F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

H. Leave windows closed and locked.

3.3 CLEANING

A. Clean window frames and glass in accordance with Division 1 requirements.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. Remove labels and visible markings.

3.5 PROTECTION

A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Section 06105 – Miscellaneous Rough Carpentry
2. Section 06201 – Exterior Finish Carpentry
3. Section 08111 – Hollow Metal Doors and Frames
4. Section 08210 – Wood Doors
5. Section 08410 – Aluminum-Framed Entrances and Storefronts.
6. Section 08713 – Automatic Door Operators
7. Section 08800 – Glass and Glazing
8. Section 09901 – Painting

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtin Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
6. FEMA 361 2008 - Design and Construction Guidance for Community Safe Rooms.
7. ICC 500 - ICC/NSSA Standard for the Design and Construction of Storm Shelters.
8. ICC/IBC - International Building Code.
9. NFPA 70 - National Electrical Code.
10. NFPA 80 - Fire Doors and Windows.
11. NFPA 101 - Life Safety Code.
12. NFPA 105 - Installation of Smoke Door Assemblies.
13. TAS-201-94 - Impact Test Procedures.
14. TAS-202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.
15. TAS-203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
16. [State Building Codes, Local Amendments].

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers and Installers are to be factory trained, certified, and a direct purchasers of the specified products and be responsible for commissioning and servicing the installed equipment indicated for the Project.

E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

F. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:
   1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
   2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Thresholds: Not more than 1/2 inch high.

4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

   a. Test Pressure: Positive pressure labeling.

H. Windstorm Resistant Exterior Openings: Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the wind loads, design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.

   1. Each unit to bear third party permanent label in accordance with the Florida Building Code requirements.

I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

   1. Prior to installation of door hardware, arrange for manufacturers' representatives to hold a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.6 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.

2. Ten years for extra heavy duty cylindrical (bored) locks and latches.
3. Seven years for heavy duty cylindrical (bored) locks and latches.
4. Five years for standard duty cylindrical (bored) locks and latches.
5. Five years for exit hardware.
6. Ten years for manual door closers.
7. Two years for electromechanical door hardware.

1.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

2. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

a. Permanent cylinders, cores, and keys to be installed by Owner.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.
c. Tornado Resistant Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

1) Out-swinging exterior doors.
2) Out-swinging access controlled doors.

5. Acceptable Manufacturers:

a. Hager Companies (HA).
b. McKinney Products (MK).
c. Stanley Hardware (ST).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

a. McKinney Products (MK).
b. Pemko Manufacturing (PE).
c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where

applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

   a. McKinney Architectural Hardware (MK).
   b. Rockwood Manufacturing (RO).
   c. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, 4-inches wide by 16-inches high, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
2. Straight Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection from face of door unless otherwise indicated.
3. Offset Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection and offset of 90 degrees unless otherwise indicated.
4. Push Bars: Minimum 1-inch round diameter horizontal push bars with minimum clearance of 2 1/2-inch projection from face of door unless otherwise indicated.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

   a. Acceptable Manufacturers:

      1) McKinney Architectural Hardware (MK).
      2) Rockwood Manufacturing (RO).
      3) Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: MIWA Lock, See owner for information.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Re-Use existing cylinders from demolition of existing openings. Verify distribution channel with owner for additional cylinders required. Coordinate with Owner the location of re-used cylinders. Existing cylinders are keyed to existing functions. The Owner will direct which reused cylinders will be used at new door locations. Cylinders not reused in the renovation shall be turned over to the Owner.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) – ML2000 Series.
    b. Sargent Manufacturing (SA) – (R)8200 Series.
    c. Yale Locks and Hardware (YA) – 8800FL Series.

B. Lock Trim Design: As specified in Hardware Sets.

C. Hurricane and Tornado Resistance Compliance: Mechanical locking and latching devices to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

    a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.

6. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
7. Rail Sizing: Provide exit device rails factory sized for proper door width application.
8. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
9. Hurricane and Tornado Resistance Compliance: Conventional exit devices and tube steel removable mullions to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

    1. Acceptable Manufacturers:

        a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
        b. Sargent Manufacturing (SA) - 80 Series.
        c. Yale Locks and Hardware (YA) - 7000 Series.

C. Extruded Aluminum Removable Mullions: ANSI/BHMA A156.3 anodized, removable mullions with malleable-iron top and bottom retainers. Mullions to be provided standard with stabilizers and imbedded weatherstrip.

    1. Acceptable Manufacturers:

        a. Sargent Manufacturing (SA) – L980 Series.
        b. Corbin Russwin.
        c. Yale.

2.8 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

    1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
    2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
    3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1 provisions for door opening force and delayed action closing.
    4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
d. Re-Use any closers salvaged in Demolition that are serviceable and meet the above criteria.

5. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
6. Hurricane and Tornado Resistance Compliance: Door closers to be U.L. listed for windstorm components where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units and high impact, non-corrosive plastic covers standard.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - DC8000 Series.
b. Sargent Manufacturing (SA) - 351 Series.
c. Norton Door Controls (NO) - 7500 Series.
d. Yale Locks and Hardware (YA) - 4400 Series.

2.9 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.

a. Stainless Steel: 050-inch thick, with countersunk screw holes (CSK).
b. Brass or Bronze: 050-inch thick, with countersunk screw holes (CSK).
c. Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

6. Acceptable Manufacturers:

a. McKinney Architectural Hardware (MK).
b. Rockwood Manufacturing (RO).
c. Trimco (TC).

2.10 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:
a. McKinney Architectural Hardware (MK).
b. Rockwood Manufacturing (RO).
c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

a. Rixson Door Controls (RF).
b. Rockwood Manufacturing (RO).
c. Sargent Manufacturing (SA).

2.11 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: :Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:

1. McKinney Weatherstripping Products (MW).
2. Pemko Manufacturing (PE).
3. Reese Enterprises, Inc. (RS).

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Antimicrobial Finishes: Where specified, finishes on locksets, latchsets, exit devices and push/pull trim to incorporate an FDA recognized. Silver Ion, antimicrobial coating (MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

D. Power Operator products and accessories are required to be installed through current members of the manufacturer's "Power Operator Preferred Installer" program.

E. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:

1. MK – McKinney
2. RO - Rockwood
3. SA - Sargent
4. MI – MIWA
5. RF - Rixson
6. PE - Pemko

Hardware Schedule

Set: 1.0

Doors: 1, 2, 36, 37

Description: Exterior Storefront Pair

2	Continuous Hinge	MCK-12HD	CL	MK
1	Removable Mullion	L980A	US28	SA
1	Exit Device (rim, pull)	16 8510 862	US32D	SA
1	Exit Device (rim, storeroom)	16 8504 862	US32D	SA
3	Cylinder	As Required (reuse from existing SF doors)	626	MI
2	Door Closer (surface)	351 O	EN	SA

Notes: Balance of Hardware: threshold, door seals, mounting brackets furnished by Storefront Door Manufacturer. Specified hardware listed as a basis of design and may be modified to meet Windstorm. Exterior openings to meet Florida Windstorm requirements

Set: 2.0

Doors: 11, 28, 29, 32
Description: Exterior Classroom

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (dormitory)	8225 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing doors)		MI
1	Door Closer (surface)	351 CPS	EN	SA
1	Kick Plate	K1050 8" x L.A.R.	US32D	RO
1	Threshold (Bumper)	2005AV		PE
1	Rain Guard	346C		PE
1	Gasketing	303AV		PE
1	Door Bottom (Rain Drip)	216AV		PE
1	Latch Protector	321	US32D	RO

Notes: Exterior openings to meet Florida Windstorm Requirements.

Set: 3.0

Doors: 17
Description: Exterior Classroom (door and hardware relocated)

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2" (provide new)	US32D	MK
1	Exit Device	(reuse existing)		
1	Cylinder	As Required (reuse from existing door)		MI
1	Door Closer (surface)	Reuse existing		
1	Kick Plate	Reuse existing		
1	Threshold (Bumper)	2005AV (provide new)		PE
1	Door Bottom	315CN (provide new)		PE
1	Gasketing	303AV (provide new)		PE
1	Latch Protector	321 (provide new)	US32D	RO

Notes: Exterior openings to meet Florida Windstorm requirements

Set: 4.0

Doors: 18, 19
Description: Exterior Office

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (dormitory)	8225 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)		MI
1	Door Closer (surface)	351 CPS	EN	SA
1	Kick Plate	K1050 8" x L.A.R.	US32D	RO
1	Threshold (Bumper)	2005AV		PE
1	Door Bottom	315CN		PE
1	Gasketing	303AV		PE
1	Latch Protector	321	US32D	RO

Set: 5.0

Doors: 34
Description: Exterior Mechanical Pair

6	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Surface Bolt	988	Bright Zinc	SA
1	Mortise Lock (storeroom)	76 8224 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)	626	MI
1	Surface Overhead Stop	9-X36	630	RF
1	Threshold (Saddle)	271A		PE
1	Rain Guard	346C		PE
1	Gasketing	303AV		PE
2	Door Bottom (Rain Drip)	216AV		PE
1	Latch Protector	321	US32D	RO

Notes: Knurled lever outside. Astragal by door manufacturer. Exterior openings to meet Florida Windstorm requirements

Set: 6.0

Doors: 35
Description: Exterior Mechanical Pair (existing to remain)

	Hinges	Existing		
	Surface Bolts	Existing		
1	Mortise Lock (storeroom)	76 8224 LNL (provide new)	US26D	SA
1	Cylinder	As Required (reuse from existing door)		MI
	Surface Overhead Stop	Existing		
	Threshold (Saddle)	Existing		
	Rain Guard	Existing		
1	Gasketing	303AV (provide new)		PE
	Door Bottom (Rain Drip)	Existing		
	Latch Protector	Existing		

Notes: Knurled lever outside. Astragal by door manufacturer. Exterior openings to meet Florida Windstorm requirements

Set: 7.0

Doors: 33
Description: Exterior IT

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (storeroom)	8224 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)		MI
1	Door Closer (surface)	351 CPS	EN	SA
1	Kick Plate	K1050 8" x L.A.R.	US32D	RO
1	Threshold (Bumper)	2005AV		PE
1	Rain Guard	346C		PE
1	Gasketing	303AV		PE
1	Door Bottom (Rain Drip)	216AV		PE
1	Latch Protector	321	US32D	RO

Notes: Knurled lever outside. Exterior openings to meet Florida Windstorm requirements

Set: 8.0

Doors: 14 (Existing door and hardware to remain)
Description: Exterior Existing Openings

1	Exist	Existing Hardware to Remain	CO

Notes: Verify balance of existing hardware in proper working order. Adjust / Replace as needed.

Set: 9.0

Doors: 9, 13, 16, 27, 30, 31,
Description: Classroom (Corridor)

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (dormitory)	8225 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)		MI
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8" x L.A.R.	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 10.0

Doors: 12, 15
Description: Classroom (Inner)

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (storeroom)	8226 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)		MI
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 11.0

Doors: 20, 21, 4, 5, 6, 7, 8
Description: Office

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (office)	8205 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)	626	MI
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 12.0

Doors: 3
Description: Storefront Single

1	Pivot	195	626	RF
1	Pivot	M19	626	RF
1	Mortise Deadlock	MS1850S	628	AD
1	Cylinder	As Required (reuse from existing door)	626	MI
1	Cylinder	4066	628	AD
1	Push Bar and Pull	11147	US32D	RO
1	Door Closer (surface)	351 O	EN	SA

Notes: Balance of Hardware: threshold, door seals, mounting brackets furnished by storefront door manufacturer.

Set: 13.0

Doors: 23
Description: Janitor

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (storeroom)	8204 LNL	US26D	SA
1	Cylinder	As Required (reuse from existing door)	626	MI
1	Mop Plate	K1050 4" x L.A.R.	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 14.0

Doors: 10
Description: Storefront Single

1	Pivot	195	626	RF
1	Pivot	M19	626	RF
1	Mortise Deadlock	MS1850S	628	AD
1	Cylinder	As Required (reuse from existing door	626	MI
1	Cylinder	4066	628	AD
1	Push Bar and Pull	11147	US32D	RO
1	Door Closer (surface)	351 O	EN	SA

Notes: Balance of Hardware: threshold, door seals, mounting brackets furnished by storefront door manufacturer.

Set: 15.0

Doors: 22, 24, 25, 26
Description: Men / Women

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Push Plate	70C	US32D	RO
1	Pull Plate	110x70C	US32D	RO
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8" x L.A.R.	US32D	RO
1	Mop Plate	K1050 4" x L.A.R.	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 16.0

Door: 39
Description: Emergency Fire Exit
(TBA)

END OF SECTION 08710

SECTION 08713

AUTOMATIC DOOR OPERATORS

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. Low energy automatic door operators for swinging doors.

B. Related Sections:

1. Section 08410 - Aluminum-Framed Entrances and Storefronts.

2. Section 08800 - Glass Glazing.

A. Codes and Standards: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

2. ANSI/BHMA A156.4 - Door Controls, Door Closers.

3. ANSI/BHMA A156.19 - Power Assist and Low-Energy Power Operated Doors.

4. ICC/IBC - International Building Code.

5. NFPA 70 - National Electrical Code.

6. NFPA 80 - Fire Doors and Windows.

7. NFPA 101 - Life Safety Code.

8. NFPA 105 - Installation of Smoke Door Assemblies.

9. UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.

10. State Building Codes, Local Amendments.

1.3 PERFORMANCE REQUIREMENTS

A. Automatic door operators to be used on exterior doors; up to 200 pounds (91 kg) weight and maximum door width of 48" (1219 mm).

1. Auto door operator capable of operating within temperature ranges of -22°F (-30°C) and 122°F (50°C).

1.4 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation devices. Include operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: Include details and attachments to other work.

1. Include locations and elevations of each unique entrance showing activation devices.

2. Indicate required clearances, components, and location and size of field connections.

3. Wiring Diagrams: For power, signal, and activation wiring.

C. Qualification Data: Provide copy of manufacturer's official certification or accreditation document indicating proof of status as a qualified and authorized installer of automatic door operators and accessories.

D. Operating and Maintenance Manuals: Provide manufacturer's operating and maintenance manual for each item comprising the automatic door operator installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturer and Installer providing the operators and installation. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Certified Installer Qualifications: Locally certified ASSA ABLOY Power Operator Preferred Installer required for the installation and maintenance of the automatic door operator units and accessories indicated for the Project.

C. Source Limitations: Obtain automatic door operators, including activation devices, from single source, qualified supplier unless otherwise indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

E. Exit Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

F. Fire Rated Door Assemblies: Provide operators for fire rated door assemblies that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and the procedures for receiving, handling, and installing automatic door operators.

1. Prior to installation of automatic door operators, arrange for certified Installer's representative to conduct a project specific meeting to review the installation and maintenance of their respective products. Project meeting to be attended by representatives of related trades furnishing and installing the aluminum, hollow metal and wood doors sections.

2. Review and finalize construction schedule and verify availability of materials.

1.6 COORDINATION

A. Electrical Systems Coordination: Coordinate the layout and installation of scheduled automatic door operators and related activation devices, with required connections to source power junction boxes, remote power supplies, access control equipment, detection and monitoring hardware, and fire alarm system.

B. Templates: Obtain and distribute to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified automatic door operators without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer, agreeing to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period after final acceptance by Owner. Failures include, but are not limited to, the following:

1. Faulty or sporadic operation of automatic door operator, including activation and safety devices.

2. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

C. Special Warranty Period: Two years from date of Substantial Completion.

D. Provide extended warranty from defects in material or workmanship under normal use for a period of 3 years from the date of substantial completion for units installed by a certified ASSA ABLOY Power Operator Preferred Installer in accordance with the manufacturer's written warranty certificate.

1.8 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance by skilled employees of automatic door operator Installer. Include planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning,

and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

B. Extended Maintenance Support and Service Agreement: Submit for Owner's consideration an optional extended Service Agreement for the installed automatic door operator system. The extended Service Agreement is considered elective and is without manufacturer's requirement stipulating mandatory coverage for owner and/or vendor system support.

1. A published copy of this agreement to be included with the submittal package

2. Support for the installed automatic door operator system is provided through the vendor under a specified, limited 24 hour support program.

3. Automatic door operators and components are to be available on a one-day turn around time frame from the vendor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Norton Door Controls (NO) - 5900 X-in Series.

2. Sargent Manufacturing (SA) - MPower CL4000 Series.

2.2 AUTOMATIC DOOR OPERATORS - GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

B. Electromechanical Door Operators: Self-contained units powered by permanent magnet DC motor, with closing speed controlled mechanically by gear train, connections for power, activation and safety device wiring, and manual operation including spring closing when power is off.

C. Electrohydraulic Door Operators: Self-contained low-pressure units with separate cylinders for power and checking, connections for power, activation, and safety device wiring and manual operation including spring closing when power is off.

D. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

2.3 LOW ENERGY DOOR OPERATORS

A. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:

a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.

b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

B. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

C. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

1. On-off switch to control power to be key switch operated.

D. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

1. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

2.4 ACTIVATION DEVICES

A. General: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

B. Push-Plate Switch: Momentary contact door control switch with push-plate actuator.

1. Configuration: Square or round push-plate control switch with single or double gang junction box mounting. Provide post-mounted unit at Door No's 36 and 37.

a. Mounting Location: As indicated on Drawings.

2. Push-Plate Material: Stainless steel.

3. Mounting Post: Stainless steel.

4. Message: International symbol of accessibility with "Push (Press) to Open (Operate)" text.

C. Touch Less Wall Switch: Momentary contact door control switch with movement required activation. Single or double gang box junction box mounting.

1. Doppler radar sensor.

2. Mounting Location: As indicated on Drawings.

D. Key Switch: Key controlled actuator device enclosed in single or double gang junction box.

1. Faceplate Material: Stainless steel.

2. Functions: On-off, maintained contact.

3. Two-way Mounting: Recess or surface mounting as indicated on Drawings.

E. Wireless or Remote Radio-Control Switch: Manufacturer's standard radio control system consisting of header mounted receiver and remote transmitter activation device.

F. Motion Sensors: Self-contained, unidirectional scanner units with adjustable detection angle pattern and field sizes.

1. Motion sensors require local authority having jurisdiction approval and must not be placed where motion of door can be sensed.

2.5 ACCESSORIES

A. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

2.6 FINISHES

A. Standard: Designations used to indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware. Units will be sprayed with a combination of waterborne acrylic and polyester powder coat.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, power connections, electrical systems interfaces, and other conditions affecting performance of automatic door operators.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 INSTALLATION

A. General: Install complete automatic door operators according to manufacturer's written instructions and ANSI/BHMA A156;19 standard, including activation devices, control wiring, remote power units if any, connection to the building's fire alarm system, and required signage.

B. Power Connection: Reference Division 16 "Electrical" Sections for connection to electrical power distribution system.

C. Access Control System: Connect operators to access control system.

D. Signage: Apply signage as required by ANSI/BHMA A156.19 standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Inspection: Certified Installer' representative to inspect and test automatic door operators to determine compliance of installed systems with specifications and ANSI/BHMA A146.19 standard. Report discrepancies in writing to Architect and Contractor within 24 hours after inspection.

3.4 ADJUSTING

A. Comply with requirements of ANSI/BHMA A156.19 standard. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer.

3.5 DEMONSTRATION

A. Certified Installer's representative to train Owner's maintenance personnel in the proper adjustment, operation, and maintenance of automatic door operators.

END OF SECTION 08713

SECTION 08800

GLASS AND GLAZING

PART 1 – GENERAL

1.1 SCOPE

A. This section describes the required materials and installation standards for all glass and glazing including, but not limited to: interior and exterior windows, sidelights, door lights and observation ports.

1.2 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only:

B. American Society for Testing and Materials (ASTM) Publications:

1. Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors
2. Water Penetration of Exterior Windows, Curtain Walls and Doors
3. Cellular Elastomeric Preformed Gasket and Sealing Material
4. Staining and Color Change of Single or Multicomponent Joint Sealants
5. Volatility of Oil and Resin Based, Knife Grade, Channel Glazing Compounds
6. Standard Specification for Flat Glass

C. American National Standards Institute, Inc. (ANSI):
797.1-75 Performance Specification and Methods of Test for Safety Glazing Material used in Buildings.

D. Consumer Products Safety Commission (CPSC) Standard:
16 CFR Safety Standard for Architectural Glazing Materials, January 1977, Part 1201

E. National Fire Protection Association (NFPA) Publication:
80-1977 Fire Doors and Windows

F. Flat Glass Marketing Association (FGMA) Publications:
Glazing Manual – 1974 Edition.
Glazing, Sealing Systems Manual, First Edition, 1970

G. National Association of Architectural Metal Manufacturers (NAAMM) Publication:
SG-1-70 Dense Rubber-Like Compression Gasket Material

1.3 SUBMITTALS: See SECTION 01300 – SUBMITTALS

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. See drawings for location of each type of glass specified herein. Unless otherwise shown, all door lights and sidelights, entrance ways and high traffic areas shall be glazed with safety glazing materials conforming to CPC 16 CFR, Part 1201.

B. All exterior glass and glazing systems shall meet the requirements of ASCE 7-05.

C. All glazing within 48 inches of a door (including door glazing) shall be tempered safety or laminate safety glass.

D. All tinted exterior glazing shall be solar gray tint.

2.2 SHEET OR FLOAT GLASS

A. Clear sheet or float glass shall be glazed in interior openings not indicated or specified otherwise. Install $^{3}/_{16}$" float glass for glazing openings up to and including 36 square feet. Install 7/32" glass

for glazing openings over 36 square feet but not over 45 square feet. Sheet for float glass shall be one of the following manufacturer's products:

1. DS Float Glass: PPG Industries, Inc.
2. DS Float Glass: Ford Glass Division
3. DS Float Glass: Guardian Industries

2.3 TINTED FLOAT GLASS

A. Tinted float glass shall be glazed in all exterior window openings. Glass thickness shall be as outlined in clear float section.

1. Light Transmittance: 58%
2. Shading Coefficient: 0.76
3. U-Value (Summer): 1.08

2.4 INSULATING GLASS

A. Insulating glass units shall be 1" total thickness.

B. Insulating glass unit shall be as follows:

1. Exterior glass shall be 1/4", grey-tinted (tempered)
2. Space shall be 1/2", Low-E coating (3).
3. Interior glass shall be 1/4" clear, tempered.

C. Insulating glass unit shall be a product of one of the following manufacturers:

1. PPG Industries, Inc.
2. Guardian Industries, Inc.
3. Oldcastle Glass, Inc.

2.5 TEMPERED GLASS:

D. Tempered glass shall be fully tempered safety glass manufactured by a special heat treating process to improve its mechanical strength. Glass shall meet the requirements of ANSI Z97.1 and USPC standard 16 CFR 1201 C1 and C11. Interior glass shall be clear and exterior glass shall be tinted with tongless edges of thickness shall be minimum of $^{7}/_{32}$" or as required by CPSC for openings size.

E. Tempered glass shall be products of one of the following manufacturers:

1. Herculite as manufactured by PPG Industries, Inc.
2. Tempered safety glass as manufactured by Ford Glass Division
3. Guardian tempered glass as manufactured by Guardian Industries, Inc.

2.6 MIRRORS:

A. Mirrors shall be ¼" Plate Glass.

2.7 SEALING MATERIALS

A. Provide neoprene setting materials of the types required for the applicable setting method specified in the FGMA Glazing Sealing Systems Manual, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers or impregnated preformed gaskets. Materials which will be exposed to view and unpainted shall be gray or neutral color.

2.8 GLAZING TAPE

A. Butyl-polyisobutylene preformed sealant complying with AAMA 804.1 for Channel Glazing.

2.9 GLAZING COMPOUND

A. Non-hardening, elastic type as recommended by glass manufacturer.

2.10 ELASTOMERIC SEALANT

A. Shall be recommended by sealant manufacturer for glazing applications of project. Sealant shall be chemically compatible with setting blocks, edge blocks, sealing tapes and with sealants used in manufacture of insulating glass units.

2.11 PREFORMED CHANNELS

A. Neoprene, vinyl, or rubber, NAAMM SG-1, as recommended by the glass manufacturer for the particular condition.

2.12 SEALING TAPES

A. Preformed, semisolid, polymeric based material of proper size and compressibility for the particular condition. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes.

2.13 SETTING BLOCKS AND EDGE BLOCKS

A. Lead or neoprene of 70 to 90 Shore durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer.

2.14 ACCESSORIES

A. As required by manufacturer to provide a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide non-corroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

PART 3 – EXECUTION

3.1 PRECAUTIONS AND PROCEDURES

A. Determine the sizes to provide the required edge clearances by field measuring the actual openings to receive the glass. Grind smooth all edges of glass that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

A. Items to be glazed shall be either shop or field glazed using glass of the quality and thickness specified or indicated. Preparation and glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA Glazing Manual and Glazing Sealing Systems Manual. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with the manufacturer's instructions. Use beads or stops which are furnished with the items to be glazed to secure the glass in place.

3.3 EDGE CLEARANCE, FACE CLEARANCE AND BITE

A. The glazing system must provide adequate edge and face clearance to properly cushion the glass, thermally and mechanically isolate the glass from the framing members and prevent glass to metal contact.

3.4 WEEP SYSTEMS

A. The glazing system must be installed to prevent accumulation of moisture in glazing channels for prolonged periods. Weep holes shall be provided to insure adequate drainage.

3.5 FLOAT GLASS

A. Cut and set with any visible lines or waves horizontal.

3.6 CLEANING

A. Thoroughly clean glass surfaces and remove labels, paint spots, putty and other defacement. Glass shall be clean at the time the work is accepted.

END OF SECTION

SECTION 09250

GYPSUM WALLBOARD (DRYWALL)

PART 1 – GENERAL

1.1 SCOPE

A. The listing herein of article or material, operation or method requires that the Contractor shall furnish and install each item listed, of quality, or subject to qualification, noted: according to conditions stated providing therefore all necessary labor, equipment, and incidentals, including:

1. Gypsum Wallboard
2. Metal trim features, including corner treatment
3. Metal wall and ceiling framing systems
4. Joint reinforcement and treatment
5. Fasteners
6. Clean-up

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM) Publications:

1. Gypsum Wallboard
2. Joint Treatment Materials for Gypsum Wallboard Construction
3. Steel Drill Screws for the Application of Gypsum Board to Light-Gauge Steel Studs
4. Application and Finishing of Gypsum Board
5. Surface Burning Characteristics of Gypsum Board

C. Underwriters Laboratories (UL) Publication:

1. Fire Resistance Directory, 1980 Edition.

D. Commercial Publication:

1. United States Gypsum Company Publications SA-923, SA-932

1.3 SUBMITTALS

A. See Section 01300 – Submittals for requirements, if any.

PART 2 – PRODUCTS

2.1 GYPSUM WALLBOARD

A. Gypsum wallboard shall be manufactured from asbestos-free materials. Gypsum wallboard shall be as follows:

1. Gypsum Wallboard: ASTM C36

1. Regular: m 48” wide, 5/8” thick, tapered edges (unless noted otherwise on drawings).
2. Type X Special Fire-Resistant: 48” wide, 5/8” thick, tapered edges (rated assemblies).
3. Cement Backer Board (CB): 48” wide, 1/2” thick, tapered edges (Provide in all toilet rooms shown to be finished with tile on cement backer board).
4. Exterior non-vented cement soffit board, similar and equal to Hardiesoffit, 1/4 inch thick, smooth, color to be selected.

2.2 JOINT TREATMENT MATERIAL: ASTM C475

A. Taping or Embedding Compound: Specifically formulated and manufactured for use in embedding tape at gypsum board joints and completely compatible with tape and substrate.

B. Finishing or Topping Compound: Specifically formulated and manufactured for use as a finishing compound.

C. All-Purpose Compound: Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape and substrate.

D. Joint Tape: Perforated cross-laminated, tapered edge, reinforced paper, or special tape recommended by the manufacturer.

E. Screws: ASTM C546, Type “S” or Type “W” steel, self-drilling and self-tapping screws.

F. Adhesives: Adhesive containing benzene, carbon tetrachloride, and trichloroethylene shall not be used.

G. Adhesive for Fastening Gypsum Board to Metal Framing: Type as recommended by the gypsum board manufacturer and approved.

H. Corner Bead and Edge Trim: Fabricate from protective-coated steel or plastic designed for its intended use. Flanges shall be free of dirt, grease and other materials that may adversely affect the bond of joint treatment. Materials shall be prefinished or decorated.

I. Water: Clean, fresh and potable.

2.3 WALL/PARTITION SUPPORTS MATERIALS:

A. Studs: 25 gauge (except noted otherwise on the drawings) screw-type “Cee” shaped studs of the depth indicated on the drawings, zinc-coated steel; comply with ASTM C645. Provide 20 gauge studs at following locations:

1. Interior door jambs in 25 gauge stud walls.
2. Studs higher than 13’-6” and where wall hung cabinets or other wall mounted equipment is to be installed.
3. At structural exterior skin locations.
4. See drawing for stud gauge for structural bearing walls.

B. Depth of Section: 3-5/8”, except as otherwise indicated on the drawings.

C. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall at other work.

D. Stiffeners: 3/4” rolled steel channels at 0.3 lb. per ft. , rust-inhibitive paint finish.

E. Stud System Accessories: Provide stud manufacturer’s standard clips, shoes, ties, reinforcements, fasteners, and other accessories as needed for a complete stud system.

F. Resilient furring channels shall be similar and equal to USG RC-1 resilient channels faced with sound absorbent acoustical tape. Install in accordance with manufacturer’s direction.

2.4 CEILING SUPPORT/FRAMING MATERIALS

A. Support/framing for suspended gypsum wallboard ceilings shall consist of 1-1/2” galvanized steel main runner channels and hat shaped galvanized steel furring channels.

2.4 HANGERS, TIE WIRES AND CLIPS

A. Hangers supporting main runner channels shall be soft steel wire not less than 0.1620” nominal diameter (8 gauge) conforming to Federal Specification QQ-W-461, AISI No. 1010, Class 2 zinc coating. Flat steel hangers, 1” by 3/16”, with zinc coating, may be substituted for the wire hangers.

B. Tie wires for splicing furring channels or securing furring to main runner channels shall be galvanized steel of not less than 0.0915" nominal diameter (13 gauge). Tie wires for splicing hat-shaped furring channels to main runner channels or to structural members shall be galvanized steel of not less than 0.0625" nominal diameter (16 gauge).

C. Clips used in lieu of wire shall be galvanized steel equivalent in holding power to that provided by tie wires for the specific application.

D. Metal trim features for wallboard shall be formed from zinc-coated steel not lighter than 0.0217: nominal thickness (25 gauge) and shall conform to Federal Specification QQ-S-775, Type I, Class D or E. Metal trim shall be in the following shapes and sizes:

E. Casing beads shall be channel shaped with a concealed wing not less than 7/8" wide and an exposed wing. Exposed wing may be covered with paper cemented to metal and shall be suitable for joint treatment.

F. Corner beads for use at perimeter of ceilings shall be angle-shaped with wings not less than ¾" wide. Concealed wing shall be perforated for nailing and exposed wing edge folded flat. Exposed wing may be factory finished in a white color.

2.5 GYPSUM WALLBOARD/ASSEMBLY FASTENERS:

A. Bolts shall conform to Federal Specification FF-B-575.

B. Expansion shields shall conform to Federal Specification FF-S-325, Group I, II, or III, of the type and class applicable.

C. Metal screws shall be not less than 1" long with self-tapping threads and self-drilling points.

D. Toggle bolts shall conform to Federal Specification FF-B-588, type and class best suited for the purpose.

E. Approved manufacturers of gypsum drywall products subject to compliance with the drawings and this section are as follows:

1. Gypsum Board and Related Products:

   a. United States Gypsum Company
   b. Flintkote Products, Genstar Building Materials Company
   c. Georgia Pacific Company
   d. Gold Bond Building Products Division, National Gypsum Company.

2. Metal Support Materials:

   a. United States Gypsum Company
   b. Gold Bond Building Products Division, National Gypsum Company
   c. Milcor Division, Inryco, Inc.

3. Direct Suspension Systems:

   a. Chicago Metallic Corporation
   b. Donn Corporation
   c. National Rolling Mills Company
   d. United States Gypsum Company

PART 3 – EXECUTION

3.1 DELIVERY AND STORAGE

A. Wallboard delivered prior to use shall be stored within a completely enclosed structure or off the ground and completely enclosed within a weathertight covering. Wallboard shall be dry, free of warpage, and with bundling tape intact immediately prior to use. Application shall commence only after the structure is completely weathertight.

3.2 CEILING FRAMED SYSTEMS

A. Framing for furred ceilings shall be installed at the locations indicated and shall conform to the following:

1. Suspended Ceilings: For spans up to and including 4' on centers: Ceiling framing shall consist of 1-1/2" steel main runner channels suspended plumb from structural slab or frame by hanger wires or straps spaced at not more than 4' on centers. Hanger wires shall be wrapped around power driven inserts installed in the supporting precast concrete slab. Hanger wires shall be looped around steel supports and shall receive three full turns around itself. Hanger strap shall be looped around structural framing and connected to itself with 3/8" galvanized bolts and nuts. Hanger wire shall be saddle-tied to main runner channels and shall receive three full turns around itself. Hanger strap shall be looped under main runner channels to form stirrups and through-bolted shall be located within 6" of parallel walls and shall be cut short of abutting walls ½" plus or minus ¼". Where channels are spliced, the ends shall be overlapped not less than 12" with flanges of channels interlocked and securely tied near each end of the splice with two loops of 16 gauge tie wire. Splices shall be staggered.

3.3 FURRING

A. Hat-shaped steel channels or steel studs shall be provided where steel furring is indicated for screw attachment of gypsum wallboard.

B. For Spans Up To and Including 4' On Centers: Hat-shaped furring members shall be spaced 16" on centers and securely attached across suspended main runner channels with wire clips or double strand of 16 gauge tie-wire saddle-tied at each crossing. Ends of wire ties shall receive three full twists. Furring shall be spliced with 8" nested laps securely tied near each end of lap with two loops of 16 gauge tie-wire. Splices shall be staggered. Furring wall channels shall be located within 2" of walls. Where wallboard abuts dissimilar wall materials, perimeter of ceilings shall be finished with an edge bead trim strip applied to wall and accurately aligned with the finished ceiling.

3.4 WALL/PARTITION SUPPORT SYSTEM:

A. Install supplementary framing, in accordance with ASTM C754. Provide blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum board alone. Blocking for TV brackets, grab bars, or other equipment shall support a minimum weight of 200 lb.

B. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

C. Anchor ends of horizontal stiffeners where system abuts structural columns or walls.

D. Install runner tracks at floors, ceilings, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

E. Space studs 16" o.c., except as otherwise indicated.

F. Fasten studs at ends of floor and ceiling runner tracks by installing a screw into both flanges at each end.

G. Install horizontal stiffeners in stud system; space 4'-0" o.c. vertically; wire-tie at each intersection.

H. Secure jamb studs to frames of openings with screws, wire-ties or welds, either directly to frames or to special frame-support brackets; and install runner track sections (for jack studs) above and below openings, secured to jamb studs.

I. Space jack studs same as partition studs, and screw to runner tracks above and below.

J. Install 2 studs at each jamb of each opening and one additional stud not more than 6" from jamb studs.

K. Install horizontal stiffeners 6” above and 6” below each opening more than 3’-0” wide, and extend 2 regular stud spaces beyond each jamb.

L. Wall furring shall be "2" members. Space furring members 24” o.c. except as otherwise indicated.

M. Install extra furring members and angle runners at terminations of drywall work, and at openings and where required for support of other work occurring in the drywall work.

3.5 APPLICATION OF GYPSUM BOARD

A. Apply gypsum board to framing and furring members in accordance with ASTM C840 and the requirements specified herein. Apply gypsum board with separate boards in moderate contact; do not force in place. Stagger end joints of adjoining boards. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings. In vertical application of gypsum board, panels shall be of length required to reach full height of vertical surfaces in one continuous piece. Surfaces of gypsum board and substrate members may be adhered together with an adhesive, except where prohibited by fire rating(s). Leave a space approximately ¼” at the bottom of gypsum board for caulking. Type of gypsum board for use in each system specified herein shall be as indicated. Screw spacing shall not exceed 8”.

B. Erection Tolerances: Wall surfaces shall have square corners, be plumb and true, with variations not exceeding 1/8’ in 8’ from required plane.

C. Control Joints: Install expansion and contraction joints in ceilings and walls in accordance with ASTM C 840, System XIII, unless indicated otherwise. See reflected ceiling plan.

3.6 FINISHING OF GYPSUM BOARD

A. Tape and finish gypsum board in accordance with ASTM C840. Provide joint, fastener depression, and corner treatment. Gypsum board finishing shall be Level 4.

B. Caulking: Caulk openings around pipes, fixtures and other items projecting through gypsum board as specified in SECTION 07900 – JOINT SEALANTS. Apply caulking material with exposed surface flush with gypsum board.

3.7 FIRE-RESISTANT ASSEMBLIES

A. Wherever fire-rated gypsum board construction is indicated, provide all materials and application methods, including types and spacing of fasteners, in accordance with the specifications contained in the UL Fire Resistance Directory for the Design Number(s) indicated.

3.8 PATCHING

A. Correct surface defects and damage as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

3.9 CLEAN UP

A. Clean up all debris caused by the work of this Section.

END OF SECTION

SECTION 09300

CERAMIC TILE

1.1 GENERAL

A. ANSI Tile Standards: Comply with ANSI A13.1 Standard Specification for Ceramic Tile and ANSI 108 series of tile installation standards included under "American National Standard Specification for the Installation of Ceramic Tile".

B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.

C. Submittals: With manufacturer's product data and installation instructions for tile work, submit samples of each type, color, and texture of tile.

1. Provide manufacturer's Master Grade Certificate.

1.2 PRODUCTS

A. Colors, Textures, and Patterns: For tile, grout, and other products requiring selection of colors, surface textures, patterns and other appearance characteristics, comply with the following requirements:

1. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for type of products indicated.
2. All interior floor tile shall be non-slip.

B. Sizes and Thicknesses: As indicated or, if not indicated, as selected by Architect from manufacturer's standard sizes and thickness. Interior tile units shall be 8" x 8".

C. Tile Grade: "Standard Grade" unless otherwise indicated.

D. Glazed Porcelain Floor and Wall Tile:

1. Glazed floor and wall tile shall be similar and equal to Dal-Tile Porcelato, ColorBody Porcelain Tile.
2. Size: 8" x 8"
3. Colors: Submit entire range of colors for selection of three colors for floor, three colors for wall.
4. Floor tile: 'Grid' skid-resistant.

E. Trim Shapes: Same material, size, standard colors and texture as field tile.

F. Marble Thresholds: Group "A"; ASTM C 503, for exterior use with minimum hardness of 10.0 per ASTM C 241; white with honed finish unless otherwise indicated.

G. Setting Materials: Provide setting materials as follows:

1. Portland Cement Mortar: Materials complying with ANSI A 108.1 and as follows:

a. Latex Additive: Manufacturer's Standard

2. Dry-set Portland Cement Mortar: ANSI A118.1
3. Latex Portland Cement Mortar: ANSI A118.4.

H. Grouting Materials:

1. Latex Portland Cement Grout: ANSI A118.6 of the following composition:

a. Prepackaged dry grout mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemuslifiable powder to which only water is added at job site.

1) Dry Polymer Additive: Polyvinyl acetate or ethylene vinyl acetate.

b. Latex additive (water emulsion) replacing part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:

1) Latex Type: Manufacturer's Standard.

I. Elastomeric Sealant: Manufacturer's standard curing, elastomeric sealants of base polymer indicated that comply with the requirements of Division 7 section "Joint Sealers", including ASTM C920 as referenced by Type, Grade, Class and Uses.

J. Miscellaneous Materials: Provide the following materials:

1. One-Part Mildew Resistant Silicone Sealants: ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and O (for use in joints in nontraffic areas).

2. Temporary Protective Coating: As follows, formulated to protect the exposed surfaces of tile against adherence of mortar and grout, compatible with tile and mortar/grout products, and easily removable without damaging grout or tile.

a. Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5 percent oil, with a melting point of 120° F (49° C) to 140° F (60° C) per ASTM D 87.
b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

K. Cement Backer Board: Equal to ½" "Wonderboard" backerboard.

1.3 INSTALLATION

A. Do not start tile work until roughing in for plumbing, heating, ventilating, air conditioning, and electrical work has been completed. Floor surfaces to receive ceramic tile set in a mortar setting bed shall not vary by more than ¼" in 10' from the required plane or slope. Floor surfaces to receive thin set ceramic tile shall not vary by more than 1/8" in 10' for the required plane or slope. Wall surfaces receiving ceramic tile shall have square corners, be plumb and true, with variations not exceeding 1/8" in 8' from the required plane.

B. Preparation of Structural Floor Slabs: Prepare in accordance with ANSI A108.1 or A108.5. Before tile is applied the structural concrete floor shall be tested for levelness or uniformity of slope by using straightedges. Area where the floor does not meet the required tolerances shall be filled and leveled in accordance with ANSI A108.5

C. Floor and Wall Tile in Dry-Set Mortar or Latex-Portland Cement Mortar: Install floor and wall tile in accordance with ANSI A108.5 where slab is not recessed and tile is scheduled. Masonry walls to receive a leveling coat of mortar prior to the application of wall tile.

D. Joints: Make parallel, plumb, level, and in alignment. Make end joints in broken-joint work, as far as practicable, on center lines of adjoining tiles. Set square tiles with straight joints, and set oblong tiles with broken joints, except in special arrangements and design, as indicated or specified.

E. Joint Width: Make joints uniform in width and space to accommodate tile in given spaces with a minimum of cutting, except maintain standard mounting widths between units abutting sheets of mounted ceramic mosaic tile. Make joint widths as follows:

1. Mounted Tile: As determined by the mounted tile spacing.
2. Unmounted Glazed Wall Tile: As determined by spacing lugs.
3. Trim Units and Accessories: Match that of adjoining tile units.

F. Grouting and Pointing: Dry-set grout may be applied over dry tile without wetting of tile. Factory premixed colored epoxy grouts may be used. Color shall be as indicated.

G. Grout glazed wall tile in accordance with ANSI A108.1 or A108.5.

H. Grout ceramic mosaic tile in accordance with ANSI A108.1.

I. Expansion and Control Joints: Provide expansion and control joints in tile work in accordance with ANSI A108.1 or A108.5 and where indicated. Unless indicated otherwise, treat expansion and control joints as follows:

1.4 CURING AND CLEANING

A. Curing: Cover floors with waterproof paper with joints lapped at least 4" and the laps tape-sealed or held down with planks or other weights. Allow to damp cure for at least 72 hours before permitting foot traffic on tiled floor. Cure in accordance with ANSI A108.1 or A108.5.

B. Cleaning: Clean in accordance with ANSI A108.1 or A108.5 except acid cleaning of unglazed tile, when necessary, shall be done no sooner than 14 days after setting tile.

1.5 PROTECTION

A. Meet the requirements of ANSI A108.1 or A108.5; cover finished tile floors with clean building paper before permitting foot traffic on them. Place board walkways on floors that are to be continuously used as passageways by workmen. Cover window stools and thresholds with boards. Protect tiled vertical outside corners (external angles) with board corner strips in areas used as passageways by workmen.

END OF SECTION

SECTION 09510

ACOUSTICAL TREATMENT

PART 1 – GENERAL

1.1 SCOPE:

A. This section includes the furnishing and installation of acoustical ceilings complete in areas of building where scheduled on the drawings.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referenced thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

B. American Society for Testing Materials (ASTM):

1. Metal Suspension Systems for Acoustical Tile Lay-In Panel Ceilings.
2. Installation of Metal Ceiling Suspension Systems (1981) for Acoustical Tile and Lay-In Panels.
3. Surface Burning Characteristics of Building Materials:
4. C-423-81a Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. Latex Ceiling Compounds (R 1981)
6. Fire Test of Building Construction and Materials.
7. Determination of Sound Transmission Class.

1.3 SUBMITTALS (See Section 01300 – Submittals)

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ceiling Sound Absorption: The Noise Reduction Coefficient (NRC) shall be determined in accordance with ASTM C-423 Method of Test.

2.2 CEILING MATERIALS

A. Acoustical ceiling units shall be mineral fiber lay-in panels with minimum NRC at 0.70 for AT-1 when tested in accordance with ASTM E 795 (E 400 mounting) and Class A flame spread rating when tested in accordance with ASTM E 84-81

B. Finish shall be factory-applied white vinyl latex paint. Size and face pattern shall be as follows.

C. Acoustical Ceiling Units AT-1 Typical: 24” x 24’ x 3/4", non-directional, all-purpose ceiling pattern, tegular, lay-in panels, product of one of the following manufacturers:

1. USG Radar Clima-Plus High NRC (#22121)
2. Armstrong Fine Fissured High NRC (#1820)
3. Celotex Fine Fissured High NRC (#HHF-454-DP)

D. D. Ceiling Tile Units AT-2 Typical: 24” x 24” x 1/2", vinyl-faced MR, gypsum wallboard ceiling panels. Grid tees shall be aluminum faced.

2.2 CEILING SUSPENSION SYSTEM: ASTM C 635 and the following requirements:

A. Type: Exposed grid, direct hung, concealed, upward access.

B. Finish: Surfaces exposed to view shall be of uniform width (15/16”) and shall be aluminum or steel with factory applied white baked enamel finish. Zinc-coated steel shall receive a phosphate treatment prior to painting.

C. Accessories: Provide manufacturer’s standard wall or edge moldings.

D. Accessibility: Provide access panels in locations indicated on the drawings. Access panels shall match adjacent acoustical units in appearance. Equip the panels with suitable framing or fastening devices designed to permit removal or replacement without damage to the units or supporting system. Access panels shall not be less than 24" x 24", no more than 24" x 48" in size.

2.3 HANGERS

A. Wires: ASTM A 641-81, soft annealed, light zinc coated carbon steel wire.

B. Straps: 1" by 1/16" galvanized steel conforming to ASTM A 526 with a light commercial zinc coating or ASTM A 366 with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

C. Rods: 3/16" diameter threaded steel rods, zinc- or cadmium-coated.

2.4 ADHESIVE: ASTM D 1779

A. Acoustical Sealant: Synthetic rubber or polymeric-based materials complying with ASTM C 834.

B. Extra Stock: Furnish one spare acoustical unit for each 100 units installed.

PART 3 – EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver acoustical units in the manufacturer's original unopened containers with brand name and type clearly marked. Handle materials carefully and store them under cover in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed.

3.2 ENVIRONMENTAL CONDITIONS

A. Maintain a uniform temperature of not less than 60° F nor more than 85° F and a relative humidity of not more than 70% continuously before, during and after installation of acoustical units. Interior finish work such as plastering, concrete and terrazzo work shall be completed and dry before installation. Mechanical, electrical and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation.

3.3 CONDITIONS OF SURFACES

A. Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Areas to which acoustical units will be cemented shall be free of oils, from residue, or other materials that reduce bonding capabilities of the adhesive.

3.4 INSTALLATION

A. Suspended Ceilings: Install the suspension system in accordance with ASTM C 635 and ASTM C 636 and the following additional requirements:

B. Hangers: Space hangers 4' on centers each direction. Hangers shall be laid out for each individual room or space. Install additional hangers where required to support framing around beams, ducts, columns, grilles, light fixtures and other penetrations through the ceiling.

C. Suspension Members: Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span.

D. Directly attach hanger wires to overhead steel structure. Where structural members do not occur at required maximum hanger location, provide 1-½" C.R. steel channels intermediate support between structural members.

E. Provide metal edge molding at perimeter of each room, space or panel and at adjacent vertical surfaces. Edge molding shall be steel with baked enamel finish. Molding shall be installed to level horizontal line, except in those areas indicated on the drawing to have sloped ceilings.

F. Erect acoustical units with joints close, straight and true to line and with exposed surfaces level and flush at joints. Make corners and arrises full and without worn or broken places. Join units neatly to connecting work.

G. Caulking: Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.4 CLEANING

A. Clean soiled or discolored unit surfaces after installation. Touch up scratches, abrasions, voids or other defects in painted surfaces. Remove damaged or improperly installed units and install new materials.

END OF SECTION

SECTION 09650

RESILIENT TILE FLOORING AND BASE

PART 1 – GENERAL

1.1 SCOPE:

A. This section includes the furnishing and installation of new resilient flooring and base for installation in areas of building where scheduled on the drawings.

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only:

1. American Society for Testing and Materials (ASTM) Publications:

a. E-84-81a: Test Method for Surface Burning Characteristics of Building Materials.

b. E-648-78: Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

c. E-662-79: Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

d. E-97: Test Method for Determining Light Reflectivity.

2. National Fire Protection Association (NFPA) Publications:

a. 56A-80: Standard for the Use of Inhalation Anesthetics (Flammable and Nonflammable)

b. 253: Flooring Radiant Panel Test (Similar to ASTM E648)

c. 258: Smoke Obscuration NBS Smoke (Similar to ASTM E662)

1.3 SUBMITTALS: See SECTION 01300 – SUBMITTALS.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Shall conform to the respective specifications and standards and to the requirement specified herein below:

B. Color and Pattern: The color and pattern of tile shall be uniformly distributed throughout the thickness of the tile. Resilient flooring materials of the same type, pattern, and color shall be of the same production run and shall be so marked. Variations in shades and off-pattern matches between containers will not be acceptable. Flooring in any one continuous area shall be from the same lot and have the same shade and pattern. See architectural drawings for tile layout design and number of colors.

C. Vinyl Composition Tile: Shall be 12" x 12' by 1/8" thick. Flame spread rating shall be 75 or less (Class B) when tested in accordance with ASTM E84. Smoke density factor shall be 450 or less when tested in accordance with ASTM E662 NBS smoke. Critical radiant flux shall be 0.45 watts/CM^2 or more when tested in accordance with ASTM E648. Light reflectivity shall be not less than 35" when tested in accordance with ASTM E97.

D. Approved manufacturers' products for vinyl composition tile are as follows:

1.	Armstrong:	Standard Excelon Series – Imperial Texture
2.	Kentile:	Architectural Series
3.	Tarkett:	Architectural
4.	Azrock:	Architectural Collection – Custom Cortina

5. Estrie Floor Products "Stonescape/Viera VCT"

E. Wall Base: Shall be flexible vinyl cove, 6" high , 0.025" thick. Cove base shall be used with resilient flooring only. Provide carpet base with carpeted areas (see SECTION 09800 – CARPETING) Provide factory formed interior and exterior corners.

F. Approved manufacturers' products for wall base are as follows:

1. Armstrong: Standard Vinyl Wall Base
2. Azrock: Vinyl Cove/ Base
3. Flexco: Vinyl Cove/ Base
4. Johnsonite: Vinyl Wall Base
5. Kentile: Vinyl Wall Base
6. Mercer Plastics: Vinyl Wall Base
7. Roppe: Vinyl Wall Base

G. Resilient Edge Strips shall be 1/8" thick by 1" (min.) wide of solid vinyl of color as selected by Architect.

2.2 ADHESIVE

A. For vinyl composition tile, vinyl stair treads, cork floor tile, wall base and edge strips shall be as recommended by the product manufacturer.

PART 3 – EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver materials to the job in the manufacturer's original unopened containers with the brands, names, and production runs clearly marked thereon. Handle materials carefully and store them in their original containers at not less than 70° F for at least 48 hours before work is started. Do not open containers until inspected and accepted.

3.2 ENVIRONMENTAL CONDITIONS

A. Maintain spaces in which flooring work is to be performed at not less than 65° F at the floor level for at least 48 hours prior to starting the work, during the time the work is performed and for at least 48 hours after work is completed. Maintain a minimum temperature of 55° F thereafter. Provide adequate ventilation to remove moisture and fumes from the area.

3.3 CONDITION OF SURFACES

A. Flooring shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Floor surfaces that are to receive flooring shall be clean, thoroughly dry, smooth, firm and sound, and free from springiness, oil, paint, wax, dirt, and any other damaging material.

B. Preparation of Surfaces:

1. Concrete Floor Surfaces: Grind all ridges and other uneven surfaces smooth. Concrete curing compounds, other than the type that does not adversely affect adhesive, shall be entirely removed from the slabs. Cut out and fill cracks 1/16" wide and wider with a crack filler as specified for this application. Prep and level existing concrete floor slab as required to receive scheduled VCT.

2. Provide latex underlayment to fill the remaining holes, cracks and depressions, and for smoothing, leveling, and feather edging the concrete. Remove loose particles, vacuum chalky, dusty surfaces and prime the cleaned surfaces if recommended by the flooring manufacturer.
3. Moisture Test for Concrete Floors: As recommended by flooring manufacturer.

3.4 APPLICATION

A. Install flooring after work of other trades that might damage flooring has been completed. Apply flooring and accessories in accordance with the manufacturer's installation procedure. Work shall

be performed by workmen experienced in the application of such flooring. Detailed requirements are as follows:

1. Adhesives: Apply adhesives in accordance with the adhesive manufacturer's printed directions, unless specified or directed otherwise. Smoking, the use of open flames, and other immediate sources of ignition are strictly prohibited in the area where solvent-containing adhesives are being used or spread. Post conspicuous signs reading "NO SMOKING OR OPEN FLAME" in the area of spread adhesive.

2. Flooring: Apply tile flooring in approved patterns. Start in the center of the room or area, and work from the center towards the edges. Keep tile lines and joints square, symmetrical, tight and even; and keep floor in a true and level plane, except where indicated as sloped. Vary edge width as necessary to maintain full-size tiles in the field but no edge tile shall be less than one half the field tile size, except where irregular shaped rooms make it impossible. Apply floor covering in accordance with manufacturer's instructions.

3. Cutting: Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut edges, fit, and scribe to walls and partitions after field flooring has been applied.

4. Reducer Strips: Provide edging (reducer) strips where flooring terminates at points higher than the contiguous finished flooring, except at doorways where thresholds are provided. Secure strips with adhesive.

B. Application of Vinyl Composition Tile: Prime concrete slabs in contact with the ground and over unventilated crawl spaces with cut-back type primer if recommended by the flooring manufacturer.

C. Work primer with a nonabsorptive base completely into the surface. Allow primer to become thoroughly dry before applying adhesive. Apply only cut-back adhesive to primed concrete surfaces. Apply recommended adhesives to suspended concrete surfaces.

D. Application of Vinyl Base: Vinyl base shall be applied after resilient flooring is completed, and the wall surface, to which the base is to be applied, is approved crack filler. Special base adhesive, as recommended by the floor covering manufacturer, shall be applied to the back of the base with a special gun manufactured for the purpose, leaving approximately ¼" bare space along the top edge of base. The base shall immediately be pressed firmly against the wall and moved gently into place, making sure that the toe is in contact with the floor and the wall. The entire surface of the base shall be rolled with a hand roller, and then the toe of the base shall be pressed firmly against the wall. Straight base for installation in carpeted areas shall be installed prior to installation of direct glue down carpet.

E. Cleaning: Immediately upon completion of the installation in a room or area, floors and adjacent surfaces shall be dry cleaned with an approved cleaner to remove surplus adhesive. No sooner than 5 days after installation, floors shall be washed with an approved non-alkaline cleaning solution, rinsed thoroughly with clean, cold, water and waxed with one coat of water-emulsion wax, buffed to an even luster with an electric polishing machine.

F. Provide one box of each color of vinyl-composition tile and 40 linear feet of vinyl base for Owner's use in maintenance.

3.5 PROTECTION

A. Cleaned flooring shall be covered with clean building paper before traffic is permitted. Board or plywood walkways shall be placed on floors used as passageways by workmen and where directed. Scratched or damaged flooring will not be acceptable and will be replaced at no additional cost to the owner.

END OF SECTION

SECTION 09681

CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specifications, apply to this section.

1.2 SUMMARY

A. This Section includes modular, textured loop carpet tile.

1.3 SUBMITTALS

A. Product Data: For each product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built in cabinets and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor
4. Type of installation
5. Pattern of installation
6. Pattern type, location and direction.
7. Pile direction
8. Type, color and location of insets and borders
9. Type, color and location of edge, transition, and other accessory strips
10. Transition details to other flooring materials. Provide edging strips as required.

C. Samples: For each of the following products and for each color and texture required. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency

G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced commercial carpet installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire Test Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Smoke Density Characteristics: Provide products with smoke density classification indicated in Part 2, as determined by testing identical products per ASTM-E-662 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 1 section “Project Management and Coordination”

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Manufacturer’s Warranty does not include discoloration or failure of carpet tile due to unusual traffic.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge,]and delamination.
3. Manufacturer’s Warranty Period: Lifetime as defined as “the period of time that the original purchaser of the carpet chooses to keep the carpet on the floor at the original installation site”.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following: Milliken, Design Rhythms, pattern Quiet Leafery.

B. Products that meet the specification requirements of the specified product for design intent must be submitted to the architect of record no less than 5 days before bid date for approval.

C. Bids utilizing products that have not been approved by the architect of record will not be accepted.

D. Fiber Type: 100% Type 6,6 Nylon

E. Pile Characteristic: Textured Loop

F. Dye Method: Millitron Post Dyed

G. Nominal Total Thickness: 0.34 inch

H. Avg Density: 6,545

I. Finished Face Weight: 20 oz.

J. Gage: 1/10

K. Total Weight: 102.4 oz/sq yard for finished carpet tile.

L. Primary Backing/Backcoating: PVC-Free Comfort Plus ES Cushion

M. Size: 36 x 36 inches

N. Applied Soil-Resistance Treatment: Stain Smart

O. Antimicrobial: AlphaSan Built-in Protection

P. Performance Characteristics: As follows:

1. Indoor Air Quality CRI Green Label Plus Certified: Certification #GLP793, Carpet Category 5Y

2. Flame Resistance: Rated Class I

3. Smoke Density: less than or equal to 450

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

a. CRI Green Label Plus Approved

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern and potential defects.

B. Concrete Subfloors: 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. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section “Concrete, General” for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with CRI 104, Section 6.2 “Site Conditions: Floor Preparation” and with carpet tile manufacturer’s written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer’s written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8” wide or wider and protrusions more than 1/32”, unless more stringent requirements are required by the manufacturer’s written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer. Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity; do not mix dye lots in the same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use non-permanent, non-staining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, “Protection of Indoor Installations”

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09800

SPECIAL COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. This Section includes applying special coating systems to items and surfaces scheduled, including surface preparation, prime coats and topcoats.

B. Types of special coating systems required for the project include:

1. Special coatings for interior use include the following:

a. Polyester-epoxy coating.

C. Related Sections: The following sections contain requirements that relate to this section:

1. General painting is specified in Division 9 section “Painting”

1.3 SUBMITTALS

A. Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each coating system specified, including block fillers and primers.

1. Provide the manufacturer’s technical information, including label analysis and instructions for handling, storing, and applying each material proposed for use.

2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer’s catalog number and general classification.

3. Certification by the manufacturer that products supplied comply with local regulations controlling the use of volatile organic compounds (VOC’s).

C. Samples for initial color selection in the form of manufacturer’s color charts.

1.4 QUALITY ASSURANCE

A. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for the Project.

B. Single Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coats for each type of coating. Use only thinners recommended by the manufacturer, and only within recommended limits.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's name, stock number and date of manufacture.
4. Contents by volume, for major pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instruction and precautions.

1.6 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 45° F and 95° F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Devoe and Raynolds Co. (Devoe).
2. The Glidden Company. (Glidden).
3. Benjamin Moore and Co. (Moore).

2.2 SPECIAL COATING MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application as demonstrated by the manufacturer based on testing and field experience.

B. Material Quality: Provide the highest grade of the various coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

C. Colors: Provide color selections made by the Architect from the manufacturer's full range of standard colors.

2.3 PRIMERS AND SEALERS

A. Primer/Sealers: Provide the manufacturer's recommended factory-formulated primer/sealers that are compatible with the substrate and finish materials indicated:

1. Pigmented Sealers Under High-Performance, Polyester-Epoxy Coatings:

a. Devoe: 12735 Tru-Glaze Epoxy Primer
b. Glidden: 5295/5299 Glidden Polyamide Epoxy
c. Moore: Tile-Like Catalyzed Architectural Coatings – High Gloss Enamel #371 and #370.

2.4 INTERMEDIATE COAT MATERIALS

A. Intermediate Coat Materials: Provide the manufacturer's recommended, intermediate coat materials that are compatible with the substrate, primers or base coat materials, and the finish materials indicated.

B. Products: Subject to compliance with requirements, provide one of the following:
1. Intermediate Coat Under Polyester-Epoxy Coatings:

a. Devoe: 124XX Tru-Glaze-4 Epoxy Coating
b. Glidden: 300 Spred Wood Undercoat.
c. Moore: Tile-Like Catalyzed Architectural Coatings – Gloss Enamel #371.

2.6 INTERIOR FINISH-COAT MATERIALS

A. Interior Finish Coat Materials: Provide the manufacturer's recommended factory formulated interior finish coat materials.

B. Products: Subject to compliance with requirements, provide one of the following:

1. High Performance, Polyester-Epoxy Coating, Gloss:

a. Devoe: 260-K-XXXX Devran 260 Seramic Epoxy Polyester Coating
b. Glidden: 5550-5552 Glid-Tile Epoxide

c. Moore: Ironclad Tile-Like Catalyzed Coatings – Clear Glaze Gloss 371/378

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which coating will be performed for compliance with requirements for application of coatings. Surfaces to receive coatings must be thoroughly dry before coatings are applied.

1. Do not proceed with application until unsatisfactory conditions have been corrected.

2. Start of coating work will be construed as the Applicator's acceptance of surfaces within particular area.

B. Coordinating Work: Review sections in which other coatings are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on the characteristics of specified finish materials to ensure compatible primers.

1. Notify the Architect of problems anticipated using the coatings specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware, hardware accessories, plates, machined surfaces, light fixtures, and similar items already in place that are not to be coated, or provide surface-applied protection prior to surface preparation and coating. Remove these items if necessary for complete coating for the items and adjacent surfaces. Following the coating operations in each space or area, have removed items reinstalled by workers skilled in the trades involved.

B. Cleaning: Before applying coatings or surface treatments, clean the substrates of substances that could impair bond of the various coatings. Schedule the cleaning and coating application so dust and other contaminates will not fall on wet, newly coated surfaces.

C. Surface Preparation: Perform surface preparation and cleaning in compliance with the manufacturer's instructions for the particular substrate conditions, and as specified.

D. Provide barrier coats over incompatible primers, or remove and reprime.

1. Cementitious Surfaces: Prepare surfaces of concrete, concrete masonry, cement plaster and similar surfaces to receive special coatings. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.

a. Use abrasive blast cleaning methods if recommended by the coating system manufacturer.

b. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish coats to blister and burn, correct this condition before application. Do not apply coatings over surfaces where moisture content exceeds that permitted in the manufacturer's printed directions.

c. Acid-etch concrete floor surfaces schedule to receive special coatings with a five-percent solution of muriatic acid or other proprietary cleaner. Flush the floor with clean water to remove acid, and neutralize with ammonia and rinse; allow to dry, then vacuum.

E. Material Preparation: Carefully mix and prepare materials in compliance with the coating manufacturer's directions.

1. Maintain containers used in mixing and application of coatings according to the manufacturer’s directions.

2. Stir materials before applying to produce a mixture of uniform density, and as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.

3. Use only the type of thinners approved by the manufacturer and only within recommended limits.

F. Tinting: Tint each under coat a lighter shade to facilitate identification of each coat where multiple coats of the same materials are to be applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. Apply special coatings by brush, roller, spray or other applicators according to the manufacturer's directions. Use brushes best suited for the material being applied. Use rollers as recommended by the manufacturer for the material and texture required.

1. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

2. Coating colors, surfaces treatments and finishes are indicated in the "Schedules" of the contract documents.

3. Provide finish coats compatible with the primers used.

4. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has curved as recommended by the manufacturer. Where sanding is required in accordance with the manufacturer's directions, sand between applications to produce a smooth, even surface.

5. When undercoats or other conditions show through the final coat, apply additional coats until the cured film has a uniform coating finish, color and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place in areas to be coated. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
b. Coat the back sides of access panels, removable or hinged covers, and similar hinged items, to match exposed surfaces.
c. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient drying time between successive coats. Do not recoat until the coating has dried so it feels firm and does not deform or feel sticky under moderate thumb pressure and where applying another coat does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to the manufacturer’s directions.

1. Brushes: Use brushes best suited for the material applied.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep’s wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: apply each material at not thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by the manufacturer.

E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: Before application of finish coats, apply a prime coat, as recommended by the manufacturer, to material required to be coated or finished, and which has not been prime coated by others.

1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

G. Brush Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

1. Apply primers and first coats by brush unless the manufacturer's instructions permit use of mechanical applicators.

H. Mechanical Applications: Use mechanical methods to apply coating when permitted by the manufacturer's recommendations and governing regulations.

1. Wherever using spray applications, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up firm thickness of two coats in one pass, unless recommended by building manufacturer.

3.4 CLEANING

A. Clean-Up: At the end of each work day, remove rubbish, empty cans, rags and other discarded materials from the site.

1. After completing work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether to be coated or not, against damage from coating. Correct damage by cleaning, repairing, replacing, and recoating as acceptable to the Architect. Leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly-coated finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.

2. At completion of other trades' construction activities, touch-up and restore damaged or defaced coated surfaces.

END OF SECTION

SECTION 09901

PAINTING

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 surfaces preparation and the application of paint systems on interior and exterior surfaces as follows:

1. Complete painting of surfaces is required whether indicated on the drawings, scheduled, or specified herein. The intent is to provide coatings on all new or newly revealed surfaces exposed to view except factory-finished or integrally colored surfaces.

2. Complete painting is required behind all equipment or fixtures whether exposed-to-view or not, as a function of providing a portion of the weather-resistant coating. This may necessitate removal and reinstallation of the equipment or fixtures as required to provide weather resistant coating. The Contractor, in his capacity as coordinator of the work, shall determine who shall remove and reinstall the equipment at no additional cost to the Owner.

3. Exposed structural areas that are scheduled or indicated to remain exposed-to-view shall receive a finish coating that is compatible with the primers and the materials to be coated.

4. Specific items intended to be left unfinished or specifically noted to have another finish applied are to be protected from these finishing operations and to be finished under other sections of these specifications.

5. Examine specifications and drawings for various other trade requirements for items that require painting. Become familiar with their provisions regarding painting. Paint or finish surfaces that are left unfinished by requirements of other specification sections including piping, conduit, etc., in exposed-to-view conditions.

6. All switch plates, coverplates, device coverplates, fixtures, grilles, or any other type of similar materials applied to the wall shall be removed prior to painting. The devices shall be reinstalled after the coating processes have been completed. Electrical and Mechanical fixtures shall, as a minimum, have prime and one finish coat applied to mounting surfaces prior to installation of fixtures.

7. All hardware that is applied or attached to any doors or other materials or equipment that are to be painted shall have all hardware removed prior to painting or coating processes, unless those hardware pieces are specifically noted to be painted. If the Contractor is unsure of the requirements for painting or coatings to be applied, he shall request in writing, the Owner's or Architect's requirements. Failure to adhere to these procedures will result in the Contractor removing and cleaning or replacing all items of field painted hardware.

8. Furnish all tools, ladders, scaffolding, and any other equipment necessary for completion of the work.

B. This section <u>does not</u> include:

1. Painting specified under other sections.

2. Painting of surfaces in concealed areas and inaccessible spaces such as furred spaces, foundation spaces, utility tunnels, pipe chases or spaces, duct shafts, or inside of elevator shafts unless otherwise noted or indicated.

3. Painting of metal surfaces that are pre-finished and are intended to remain as factory finished and all plated metals intended to remain unfinished, except where specifically required herein or as noted on the drawings.

4. Painting of any moving parts of operating units,, hinges, valves, operators, linkages, sensing devices, motor shafts, etc., unless specifically noted otherwise.

5. Painting over labels or equipment identification, performance rating, name or nomenclature plates.

6. Painting of any pre-finished wall plates or outlet covers unless specifically noted to match interior or exterior color schemes.

C. This Section includes surface preparation and the application of paint systems on the following substrates:

1. Concrete
2. Concrete masonry units (CMU)
3. Steel (including all exposed-to-view steel framing)
4. Galvanized metal (including all exposed-to-view metal deck and steel roof framing)
5. Wood
6. Gypsum Board
7. Plaster
8. Synthetic Wood Trim
9. Fiber reinforced plastics.

D. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 05 Sections for shop and/or field finishing of aluminum and steel railings.
3. Division 06 Sections for shop priming carpentry with primers specified in this Section.
4. Division 08 Sections for factory priming windows and doors with primers specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Printout of current Master Painters Institute "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
b. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
c. Other items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply up to four (4) additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

C. Qualifications of Workmen:

1. Provide at least one person who shall be present at all times during the execution of the work of this Section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under them.
2. Provide adequate numbers of workmen skilled in the necessary crafts and informed of the methods and materials to be used.
3. In acceptance or rejection of the work of this Section, the Architect will make no exception for the lack of skill on the part of the workmen.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

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 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Sherwin-Williams Company (basis of design and paint systems)
2. Benjamin Moore & Co.
3. Color Wheel Paints & Coatings
4. Coronado Paint
5. Duron, Inc.
6. ICI Paints
7. Porter Paints
8. PPG Architectural Finishes

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Aluminum Substrates: Remove surface oxidation.

I. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

K. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

L. Synthetic Wood and Fiber Reinforced Plastic Substrates:

1. Prepare surfaces and paint materials as recommended by the molding manufacturer. If moldings get dirty during installation, clean with a light detergent and warm water. For stubborn stains use denatured alcohol or one part bleach to five parts water.
2. Correct dents and gouges before applying primer.

3. Prime edges, ends, faces, undersides and backsides.
4. After priming, fill holes and imperfections in the finish surfaces with filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: See mechanical and electrical specification sections for specific and additional painting and coating requirements. Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear that does not have factory-applied final finishes.
b. Panelboards that do not have factory-applied final finishes.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
d. Plywood terminal boards, where required, shall be finished with two coats of fire-resistant paint. Color as selected by Architect.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Testing agency will perform tests for compliance of paint materials with product requirements.
2. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with

rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. The systems listed below shall be used in all areas where applicable. Not all systems will be used.

B. Concrete Substrates, Nontraffic Surfaces:

1. Latex Over Sealer System: MPI INT 3.1A

a. Prime Coat: Interior latex primer/sealer (SW B28W400)
b. Intermediate Coat: Interior latex matching topcoat. (SW B20W2251)
c. Topcoat: Interior latex (eggshell) (SW B20W2251)

C. CMU Substrates:

1. Latex System: MPI INT 4.2A.

a. Prime Coat: Interior/exterior latex block filler. (SW B51W20)
b. Intermediate Coat: Interior latex matching topcoat. (SW B20W2251)
c. Topcoat: Interior latex (eggshell) (SW B20W2251)

D. Steel Substrates:

1. Alkyd System: MPI INT 5.1E (for exposed to view metal deck and steel roof framing)

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss)

E. Galvanized-Metal Substrates:

1. Alkyd System: MPI INT 5.1E (for exposed to view metal deck and steel roof/floor structural framing)

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss)

2. Water-Based Dry-Fall System: MPI INT 5.1C

a. Prime Coat: Alkyd anti-corrosive metal primer (SW B50Z series).
b. Topcoat: Waterborne dry fall (SW B42W1)

F. Dressed Lumber Substrates: Including architectural woodwork or wood doors.

1. Latex System: MPI INT 6.3T

a. Prime Coat: Interior latex-based wood primer (SW B51W20)
b. Intermediate Coat: Interior latex matching topcoat (SW B31-2200 series)
c. Topcoat: Interior latex (semigloss) (SW B31-2200 Series)

G. Gypsum Board Substrates:

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex primer (SW B28W400)
b. Intermediate Coat: Interior latex matching topcoat (SW B20-2200 series)
c. Topcoat: Interior latex (eggshell) (SW B20-2200 series)

H. Plaster Substrates:

1. Latex System: MPI INT 9.2A

a. Prime Coat: Interior latex primer/sealer (SW B28W400)
b. Intermediate Coat: Interior latex matching topcoat (SW B20-2200 series)
c. Topcoat: Interior latex (eggshell) (SW B20-2200 series)

3.7 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. High Build Latex System: MPI EXT 3.1L, applied to dry film thickness of not less than 10 mils.

a. Prime Coat: Alkali-resistant primer or as recommended in writing by topcoat manufacturer (SW A24-300 series)
b. Intermediate Coat: High-build latex (exterior) (SW A44W800 series – smooth).
c. Topcoat: High build latex (exterior) (SW A44W800 series – smooth).

2. Latex Aggregate System: MPI EXT 3.1N.

a. Prime Coat: Alkali-resistant primer or as recommended in writing by topcoat manufacturer (SW A24-300 series)
b. Intermediate Coat: High-build latex (exterior) (SW A44W800 series – smooth).
c. Topcoat: Latex stucco and masonry textured coating (SW A44W800 series – textured).

B. CMU Substrates:

1. High Build Latex System: MPI EXT 4.2K, applied to dry film thickness of not less than 10 mils.

a. Prime Coat: Alkali-resistant primer or as recommended in writing by topcoat manufacturer (SW A24-300 series)
b. Intermediate Coat: High-build latex (exterior) (SW A44W800 series – smooth).
c. Topcoat: High build latex (exterior) (SW A44W800 series – smooth).

2. Latex Aggregate System: MPI EXT 4.2B.

a. Prime Coat: Alkali-resistant primer or as recommended in writing by topcoat manufacturer (SW A24-300 series)
b. Intermediate Coat: High-build latex (exterior) (SW A44W800 series – smooth).
c. Topcoat: Latex stucco and masonry textured coating (SW A44W800 series – textured).

C. Galvanized-Metal Substrates:

1. Latex Over Water-Based Primer System: MPI EXT 5.3H.

a. Prime Coat: Waterborne galvanized-metal primer (SW B66-310 series)
b. Intermediate Coat: Waterborne Light Industrial topcoat (SW B66-200 series)
c. Topcoat: Waterborne Light Industrial topcoat (semi-gloss) (SW B66-200 series)

D. Dressed Lumber, Synthetic Wood Substrates and Fiber Reinforced Plastic:

1. Latex System: MPI EXT 6.3L

a. Prime Coat: Exterior latex wood primer (SW B42)
b. Intermediate Coat: Exterior latex matching topcoat (SW A82 series)
c. Topcoat: Exterior latex (semi-gloss) (SW A82 series)

END OF SECTION

SECTION 10100

MARKER AND TACKBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SCOPE

A. This section covers the furnishing and installation of dry erase boards (markerboards) and tackboards at locations shown on the drawings.

1.3 SUBMITTALS – See SECTION 01300 – SUBMITTALS

1.4 DELIVERY AND STORAGE

A. Deliver markerboards and tackboards to the job site in original factory shipping containers. Care shall be exercised to prevent damage during delivery, handling and storage. Store all materials flat in a clean, dry storage area.

PART 2 – PRODUCTS

2.1 MARKERBOARDS

A. (Basis of Design: Claridge): The following manufacturers are also approved: AKI, Greensteel, Inc., Caroline Chalkboard Co., American, Florida Education Industries, Newline Products, Inc., and Bestrite Manufacturing.

B. Shall be factory built and framed units. Units shall be of height and length as indicated on the drawings. Units shall be full length with no joints.

C. LSC Liquid Chalk Porcelain Enamel Writing Surface (markerboards) shall be applied over 24 gauge steel sheet. Backerboard shall be 7/16" or 3/8" hardboard. Rear face of backerboard shall be covered with 0.005" aluminum foil. Writing surface shall be gray or white. Trim for LCS board shall be as specified below.

D. Porcelain enamel coating shall demonstrate no cracks or ruptures in the bond after dropping a 1" diameter steel ball with an impact of 80 lbs. on a 1" ball resting on chalkboard surface.

E. Markerboard trim shall be extruded aluminum 1½" minimum wide designed to be mounted with 2" aluminum angle hangers and concealed fasteners. Marker trough shall project 2-3/4" from face of markerboard and shall be full length of markerboard. Top rail of markerboards shall have special aluminum trim with integral cork strip for function as a display and map rail. Markerboard for Piano Lab shall have four sets of music staff lines.

F. Provide end stops at each end of cork strip. Cork strip shall be same material and color as tackboard specified in this section.

G. Trim shall be similar to Series 1 as manufactured by Claridge Products and Equipment Co.

H. Accessories: Each markerboard shall receive the following:

1. Two (2) metal map hooks
2. Four (4) roller brackets
3. One (1) flag holder

2.2 TACKBOARDS

A. Shall be factory built and framed units. Units shall be of height and length as shown on the drawings. Frame shall match Markerboard frame.

B. Fabricork vinyl on ¼" cork over ¼" hardboard or 1/8" cork over 3/8" wood fiber. Frame shall match markerboards but without marker tray. Provide map rail with each unit where adjacent to markerboards.

C. Size of each is indicated on drawings.

D. Color of fabric will be selected by the Architect.

2.3 EXHIBIT RAIL

A. Equal to Claridge EDR with fabricork. See drawings for length. Selection of color by Architect.

PART 3 – EXECUTION

3.1 GENERAL

A. Install markerboards and tackboards at locations and heights as shown on the drawings and in accordance with manufacturer's printed instructions. Markerboards and tackboards shall be mounted to walls utilizing 2" aluminum angle clips securely fastened to wall with ¼" toggle bolts with trim connected to clip angles at edges to conceal fasteners. Marker and tackboards shall be mounted securely, plumb and level, and free from "give" when pressure is applied.

B. Upon completion of markerboard installation, markerboards shall be cleaned and "broken-in" as recommended by manufacturer. Tackboard surfaces shall be cleaned thoroughly.

C. Eliminate sharp corner of metal trim such as ends of marker trays.

3.2 COORDINATION

A. Contractor shall field verify the final location of all marker and tackboards with Division 16 Contractor(s) and shall provide all cutouts for required outlet interface. Cutouts shall be coordinated and shall be capable of being completely covered by the plate.

3.3 GUARANTEE

A. Markerboard and chalkboard writing surface materials shall be guaranteed free from defects in writing and erasing qualities for fifty years. Guarantee shall be in consideration of normal usage and maintenance of markerboards and shall be limited to replacement of materials only F.O.B. destination and not inclusive of labor costs incidental to removal or reinstallation.

END OF SECTION

SECTION 10160

TOILET PARTITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of toilet partitions is indicated on drawings.

B. Types of toilet compartments include:

1. Solid plastic, homogenous color.

C. Styles of toilet compartments include:

1. Floor-anchored, overhead braced.

D. Styles of screens include:

1. Wall-hung.

E. Style of lavatory vanity top, edge and backsplash:

1. Wall-supported (see architectural drawings).

F. Toilet Accessories

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of toilet partition assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

C. Samples: Submit full range of color samples for each type of unit required. Submit 6" square samples of each color and finish on same substrate to be used in work, for color verification after selections have been made.

1.04 QUALITY ASSURANCE:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances where ever taking field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Available Manufacturers: subject to compliance with requirements, manufacturers offering products which may be incorporated in the work.

B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Basis of Design: “POLY-MAR HD” by Santana Products Corporation

a. Capitol Partitions
b. General Partitions
c. Comtec Industries.

2.02 MATERIALS:

A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Solid Plastic: High density, solid polyethylene with homogenous color throughout. Provide material not less than 1" thick, seamless construction with edges eased.

C. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel, not less than 3: high, 20 gage, finished to match hardware.

D. Stirrup Brackets: Manufacturer's continuous design for attaching panels and screens to walls and pilasters, either chromium-plated non-ferrous cast alloy ("Zamac") or anodized aluminum. Brackets shall be continuous.

E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chromium-plated non-ferrous cast alloy ("Zamac").

F. Overhead-Bracing: Continuous extruded aluminum, anti-grip profile, with clear anodized finish.

G. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

2.03 FABRICATION:

A. General: Furnish standard doors, panels, screens, and pilasters fabricated for partition system, unless otherwise indicated. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Door Dimensions: Unless otherwise indicated, furnish 24" wide inswinging doors for ordinary toilet stalls and 32" wide (clear opening) outswinging doors at stalls equipped for use by handicapped.

C. Hardware: Furnish hardware for each compartment in partition system, as follows:

1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type, to suit manufacturer's standards.

2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for emergency access, with combination rubber-faced door strike and keeper.

3. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.

4. Door Pull: Manufacturer's standard unit for out-swing doors.

2.04 FINISHES:

A. Color: One of manufacturer's standard colors in each Toilet Room, as selected by Architect.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb, and level. Provide clearances of not more than ½" between pilasters and panels, and not more than 1" between panels and walls. Secure panels to walls with continuous stirrup brackets. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with continuous stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.

B. Overhead-Braced Partitions: Secure pilasters to floor and level, plumb, and tighten installation with devices furnished. Secure overhead-brace to each pilaster with not less than two fasteners. Hang doors and adjust so that tops of doors are parallel with overhead-brace when doors are in closed position.

C. Floor-Supported Partitions: Set pilaster units with anchorages having not less than 2" penetration into structural floor, unless otherwise recommended by partition manufacturer. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

D. Screens: Attach with continuous anchoring devices as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

E. Lavatory Vanity Counters: Attach with anchoring devices as recommended by manufacturer to suit supporting structure. Set units to provide support and resist lateral and vertical impact.

3.02 ADJUST AND CLEAN:

A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on inswinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION

SECTION 10425

SIGNS

PART 1 – GENERAL

1.1 SCOPE

A. This section includes the furnishing and installation of specialty signs including room identification, building identification and an exterior sign.

1. All signs shall be produced by a single manufacturer and shall include mounting hardware.
2. Provide listing of sign types, lettering, and locations to be attached with overall dimension of each sign.
3. Provide the following signs for each door or pair of doors:
   a. Room occupancy name (See plans for name. Where abbreviations were used on the plans, substitute full name. Verify names with Owner prior to fabrication)
   b. Room number
   c. FISH number
   d. Accessible Toilet Room pictogram (for handicapped toilets, see plans)
   e. Toilet Room pictogram (for non-handicapped toilets, see plans)
4. Do not deliver sign until ready for their installation. Protect from damage during delivery, handling, storage, and installation.
5. All signage shall meet ADA requirements.

1.2 SUBMITTALS – See SECTION 01300 – SUBMITTALS

PART 2 – PRODUCTS

2.1 IDENTIFICATION SYSTEM

A. Room Signage, Type S-1

1. Signs of laminated or colored plastic of total thickness 0.125 inch.

   a. Room Occupancy Name and Room Number (FISH) sign shall be attached with two stainless steel screws. In addition, provide adhesive backs to signs as recommended by the manufacturer for permanent mounting.

2. Size of Sign: 4” high x number of characters plus 3/4” each end or as shown on the drawings.
3. Color: Dark matte background with white message.
4. Letters: Letters shall be raised 1/32” and shall be ¾” tall with Grade 2 Braille matching sign message. All letters shall be caps.

B. FISH Number

1. Signs of laminated or colored plastic of total thickness 0.125 inch.

   a. FISH number sign shall be attached to doorhead frame with two stainless steel screws. Provide one sign at each door frame.

2. Size of Sign: 1-1/2” high x number of characters plus 3/8” each end, or as shown on the drawings.
3. Color: Dark matte background with white letters.
4. Numbers shall be engraved into laminate 1/32 of an inch and shall be ¾” tall.

C. Pictograms:

1. 6” minimum border printed with smaller international symbol inside with verbal description below and Grade 2 Braille. See Room Occupancy Name signage requirements for material, lettering and color. Secure pictogram with four stainless steel screws and adhesive.

D. Location:

1. Signs are to be placed on the wall adjacent to the latch side of the door.
2. The dimension from the floor to the centerline of the sign or sign groupings is to be 60".
3. For double-doors or if no wall space exists, sign to be placed on the nearest adjacent wall.
4. Space from door swing or any obstacles is to be a minimum of 3".
5. For overhead signs, the clearance is to be 6'-8" (80").

2.2 EXTERIOR SIGN: "FIRE ALARM PULL STATION INSIDE" – SIGN S-4

A. Sign 15" x 5" x 0.125, acrylic background, red matte.
B. White letters, size proportional to sign dimensions (minimum height to be 5/8').
C. Unit shall be equal to "Volmar 18T" Series
D. All interior fire alarm pull stations shall have this signage at the nearest exterior door.
E. Provide Grade 2 Braille pictogram on fire alarm signage matching sign message.

2.3 ACCESSIBLE AND NON-ACCESSIBLE TOILET ROOM PICTOGRAM – SIGN S-3

A. Sign 6" x 6" x 0.125" thick acrylic background with universal pictogram (color to be selected by Architect).
B. Mount at 5'-0" above finish floor to centerline of sign.
C. Attach with four stainless steel screws and wall adhesive.
D. Provide handicapped pictogram at all accessible Toilet Rooms and all Group Toilets.
E. Provide standard pictogram at all other Toilet Rooms that are not accessible.

2.4 FIRE EXTINGUISHER SIGNAGE: "FIRE EXTINGUISHER INSIDE" – SIGN S-2

A. Sign 6" x 6" x 0.125" thick red matte acrylic background with 5/8" raised (1/32") white letters and numbers. Provide Grade 2 Braille at bottom of sign to match sign message.
B. Mount at 5'-0" above finish floor to centerline of sign.
C. Attach with four stainless steel screws and wall adhesive.
D. Provide one sign outside of all rooms containing FE's and FEC's

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install sign units and components at locations shown or scheduled, securely mounted with theft-resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with manufacturer's instructions.

B. Install level, plumb, and at proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Construction Manager.

END OF SECTION

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Fire extinguisher - See plans for locations.
2. Fire extinguisher cabinets - See plans for locations.
3. Mounting Brackets.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified. For fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

C. Samples for initial selection purposes in form of manufacture's color charts showing full range of colors available for those units with factory-applied color finishes.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain fire extinguisher and cabinets from one source from a single manufacturer.

B. Coordination: Verify that fire extinguisher cabinets are sized to accommodate fire extinguisher specified.

C. UL-Listed Products; Fire extinguisher UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

D. FM-Listed Products: Fire extinguisher approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher and carry appropriate FM marking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allenco.
2. Ansul Fire Protection, Wormald US Inc.
3. Badger-Powhatan.
4. Bobrick Washroom Equipment, Inc.
5. J.L. Industries.
6. Larsen's Manufacturing Co.
7. Modern Metal Products by Muckle.
8. Potter-Roemer, Inc.
9. Samson Metal Products, Inc.
10. Walter Kidde, Division of Kidde, Inc.
11. Watrous Inc.

2.2 FIRE EXTINGUISHER

A. General: Provide fire extinguisher for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, which comply with requirements of governing authorities.

1. Abbreviations indicated below identify extinguisher types related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher.

B. Multipurpose Dry Chemical Type: UL-rated 2-A:10:B:C, 10-lb. nominal capacity, in enameled steel container with current inspection labels attached.

2.3 FIRE EXTINGUISHER CABINETS

A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguisher of types and capacities indicated.

B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:

1. Semirecessed: Cabinet box (tub) partially recess in 8" masonry walls.

D. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.

E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.

2. Door Glazing: Tempered float glass complying with ASTM C1048, Type I, Quality q3, Class as follows:

a. Clear glass, Class 1 (transparent).

F. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" applied to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing, and location or, if not otherwise indicated, as selected by Architect from manufacturer's standard arrangements.

1. Application Process: Engraved.
2. Door Style: Manufacturer's standard design.
3. Full-Glass Panel: Float glass, 1/8-inch thick.

G. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.4 FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

2.5 STEEL FIRE EXTINGUISHER CABINET FINISHES

A. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

1. Color and Gloss: As indicated by reference to manufacturer's standard color and gloss designations.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

A. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

B. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

C. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguisher is not indicated, locate as directed by Architect.

END OF SECTION

SECTION 10620

METAL SHELVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. The extent of the metal shelving is shown on drawings.

B. Installation shall include all accessory items, such as clips, braces, splices, feet, and angles for a complete installation.

1.3 QUALITY ASSURANCE

A. Provide each type of metal shelving as a complete unit produced by a single manufacturer, including necessary accessories, fittings, and fastenings.

1.4 SUBMITTALS (See Section 01300)

A. Manufacturer's Data: For information only, submit two copies of manufacturer's technical data installation instructions for all materials required. Transmit copy of each instruction to Installer.

B. Shop Drawings: Submit shop drawings for fabrication and erection of metal shelving. Include plans, elevations, and large scale details. Submit colors for selection.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Do not deliver units until construction is substantially complete and ready for their installation. Protect from damage during delivery, handling, storage and installation.

PART 2 – PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General: All dimensions specified for components are minimum. Do not use components less than the size indicated; use larger size components as recommended by manufacturer.

B. Basis of Design: Republic Steel, Clip Shelving System, open units.

C. Manufacturer: Provide metal shelving as manufactured by one of the following:

1. Republic Steel, Industrial Products Division.
2. Hallowell Group, Automated Systems Div., SPS Technologies
3. Penco Products, Inc.
4. Bay Products, Division of American Metal Works, Inc.

D. Frames: Provide manufacturer's standard beaded and angle post.

E. Shelves: Provide manufacturer's standard gauge metal shelves to withstand a loading of 200 lbs. per shelf.

F. Manufacturer's standard shop applied enamel finish

1. Provide colors of materials for metal shelving and accessories as indicated or, if not indicated, as selected by the Architect from manufacturer's complete color line. Not more than two colors will be selected.

PART 3 – EXECUTION

3.1 INSPECTION

A. Installer must examine the areas and conditions under which metal shelving units are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

A. Provide all bolt, hardware and accessories for complete installation.

B. Erect units plumb, rigid, properly aligned and securely fastened in place.

1. Anchor to walls where unit abuts a wall.

C. Provide additional field bracing as shown or necessary for rigid, secure installation to adjacent wall.

D. Touch-up paint damaged finish after completion of installation using field-applied paint to match color of shop-applied finish.

END OF SECTION

SECTION 10800

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SCOPE

A. This section describes the materials and requirements for installation of washroom accessories shown on the drawings.
B. Coordinate work described in this section with work of other trades to insure proper installation.

1.3 STANDARDS

A. Location and mounting of toilet accessories shall comply with ADA and ANSI 117.1 for compliance with physically handicapped accessibility.

1.4 SUBMITTALS

A. See Section 01300 – Submittals.

PART 2 – PRODUCTS

2.1 GENERAL

A. Materials and Fabrication: All accessories shall be fabricated in accordance with commercial practice, with welds ground smooth. Bending, flanging, drawing, forming, and similar operations performed in a manner to ensure that there are no defects. Flanges of recessed accessories shall return to walls to provide a continuous, tight-against-the-wall installation. Doors shall be warp free. Key manufacturer's standards locks alike for groups of accessories; two keys furnished for each group.
B. Finishes: Finishes on metals not specified otherwise shall be provided as follows:

Metal	Finish
Corrosion-Resisting Steel (Stainless Steel)	General purpose polished
Aluminum	Satin Anodic, Clear
Carbon Steel	Bright Chromium Plate
Copper Alloy (Brass)	Bright Chromium Plate
Zinc Alloy (ZAMAC)	Bright Chromium Plate

C. Accessory Schedule: Provide one of the following manufacturer's products for each item listed:

D. Mirrors: Fixed style with 18 gauge 304 stainless steel frame and No. 1 quality ¼" tempered float/plate glass with silver coating, copper protective coating and non-metallic paint coating. See drawings for size.
Bobrick #B165
Bradley #700
American Specialties, Inc. #0600

E. Mirror (Tilted): 16" x 30" tilted style with Type 304 stainless steel heliarc welded corner frames and ¼" triple silvered back plate glass mirror.
Bobrick #B294
Bradley Model #740-2
American Specialties, Inc. #0535

F. Grab Bars: 1-1/2" diameter Type 304 stainless steel with concealed mounting flanges in lengths and configurations shown on the drawings. Anchorage shall resist a vertical pull test of 250 lbs.

for five minutes without pull-out. Clearance between wall and grab bars shall be 1-1/2" maximum for compliance with ANSI 117.1.
Bradley Series #812
Bobrick #B6206
American Specialties, Inc. #3200 Series

G. Paper Towel Dispenser: Surface Mounted, furnished by Owner installed by Contractor.

H. Soap Dispenser: Surface mounted, furnished by Owner installed by Contractor.

I. Toilet Tissue Dispenser: Shall be surface mounted, furnished by Owner installed by Contractor.

J. Sanitary Napkin Disposal: Surface mounted 22 gauge Type 304 stainless steel.
Bobrick #B270
Bradley Model #4781
American Specialties, Inc. #0852

K. Mop and Broom Holder: 18 gauge satin finish stainless steel unit by length indicated.
Bobrick #B239
Bradley Model #9933
American Specialties, Inc. #1308A

L. Waste Receptacle: Surface mounted Type 304 stainless steel to hold a minimum of 12 gallons with heavy duty liner equal to Bradley Model #356.

M. Waste Receptacle: Recessed, type 304 stainless steel to hold min. 12 gallons with heavy duty liner equal to American Specialties, Inc. #0458.

N. Room Deodorant Dispenser: to be furnished by Owner, installed by Contractor.

PART 3 – EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver materials to site in unopened containers, labeled with the manufacturer's names and brands, ready for installation. Store accessories in a safe, dry location, until needed for installation.
B. Locate toilet accessories as shown on the drawings. Grab bars shall be mounted at heights required by ANSI 117.1 and ADA.

3.2 INSTALLATION

A. Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Concealed anchorage wherever possible, exposed screw heads shall be tamper-proof design. Protect exposed surfaces of accessories with strippable plastic or by other approved means until the installation is accepted.
B. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.
C. Surface Mounted Accessories: Mount on concealed backplates, except where specified otherwise. Accessories without backplates shall have concealed fasteners.
D. Except as otherwise indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon, or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar.
E. Fasten all accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to 2 x 8 wood blocking secured between wood studs, or to metal backplates secured to metal studs.
F. Protect accessories from damage until final acceptance of the project. Damaged accessories or secured finishes shall be replaced. Clean all accessories after installation.

END OF SECTION

SECTION 11132

PROJECTION SCREENS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Manually operated front projection screens.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of screen specified.

C. Shop drawings showing layout and types of projection screens. Show the following:

1. Location of screen centerline.
2. Anchorage details.
3. Accessories.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain the projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.

B. Protect screens from damage during delivery, handling, storage, and installation.

C. Protect surfaces of rear projection screens from damage due to abrasion, dust, and other conditions.

PART 2 - PRODUCTS

2.01 PROJECTION SCREEN SURFACES, GENERAL

A. Measurement of Gain of Screen Viewing Surface: Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172D(1) for determining effect of reflected light at various viewing surfaces having a reflectivity equal to the magnesium carbonate surface.

B. Material and Viewing Surface of Front Projection Screens: Obtain screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:

1. Matte white viewing surface with minimum gain characteristics complying with FS GG-S 00172D(1) for Type A screen surface.

a. Edge Treatment: Black masking borders.

2. Seamless Construction: Provide screens in sizes indicated without seams.

3. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by Federal Standard 191A/5760.

4. Fire Performance Characteristics: Provide projection screen fabrics identical to those materials that have undergone testing and passed requirements for flame resistance as indicated below:

a. NFPA 701 per small-scale test.

2.02 MANUALLY OPERATED FRONT PROJECTION SCREENS

A. General: Provide manufacturer's standard units consisting of case, screen, mounting accessories and other components as required for a complete installation and complying with descriptive requirements indicated below.

B. Spring-Roller-Operated Projection Screens: Units designed and fabricated for wall or ceiling installation and complying with the following requirements:

1. Screen Case: Fabricated in one piece from not less than 22-gage steel with flat back design, vinyl-covered or baked-enamel finish, and end caps with integral roller brackets and furnished with universal mounting brackets in finish matching end caps to enable attachment to wall or ceiling.

2. Screen: As indicated below, with top edge mounted on, and securely anchored to, a 3-inch-diameter rigid steel spring roller and bottom edge formed into a pocket holding a tubular metal slat with ends of slat protected by plastic caps and saddle and pull attached to slat by screws.

a. Material: Vinyl-coated glass fiber fabric.
b. Size: 70" x 70"
c. Provide extra drop length of dimension indicated to comply with requirements for fabric color and location of drop length.
d. Color: Black
e. Location: At top of screen.

C. Products: Subject to compliance with requirements, provide one of the following:

1. "Series 500 Auditorium," Bretford Manufacturing, Inc.
2. "Model C," Da-Lite Screen Co., Inc.
3. "Luma 2," Draper Shade & Screen Co.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.

B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges plumb and flat viewing surfaces when screen is lowered.

1. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.02 PROTECTION AND CLEANING

A. Protect projection screens after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION

SECTION 12211

HORIZONTAL LOUVER BLINDS

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 the following:

1. Horizontal louver blinds with aluminum slats.

B. Related Sections include the following:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

C. Samples for Initial Selection: Show fabrication and installation details for horizontal louver blinds.

1. Include similar samples of accessories involving color selection.

D. Samples for Verification: For each type and color of horizontal louver blind indicated.

1. Slat: Not less than 12 inches long.
2. Tapes: Full width, not less than 6 inches long.
3. Horizontal Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long.
4. Valance: Full-size unit, not less than 12 inches wide.
5. Cornice: Full-size unit, not less than 12 inches wide.

E. Window Treatment Schedule: For horizontal louver blinds. Provide at all operable windows (W-1, W-2, W-3) and fixed-view windows (VW) of Building S.

F. Product Certificates: For each type of horizontal louver blind, signed by product manufacturer.

G. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to

authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency. Flame-Resistance Ratings: Passes NFPA 701.

C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and executions.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to the following:

1. Hunter-Douglas
2. Levolor, a Newell Rubbermaid Company
3. Springs Window Fashions Division, Inc.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile.

1. Width: 2 inch
2. Thickness: Manufacturer's standard.
3. Finish: One color.

a. Ionized Coating: Antistatic, dust-repellent, baked polyester finish.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and end plugs and the following:

1. Capacity: One blind per headrail.
2. Integrated Headrail/Valance: Curved face
3. Light-blocking lower back lip.
4. Tilt limiter with preselected degree settings.

D. Bottom Rail: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends top contoured to match crowned shape of slat; with enclosed ladders and tapes to prevent contact with sill.

E. Ladders: Evenly spaced to prevent long-term slat sag.

1. Blinds with Nominal Slat Width 2 Inch or More: Manufacturer's standard-width cloth tapes.

a. Tape Color, Texture, and Pattern: Color, texture, and pattern as selected by Architect from manufacturer's full range.

F. Lift Cords: Manufacturer's standard.

G. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing over-rotation, and linkage rod, and the following:

1. Tilt Operation: Manual with clear plastic wand.
2. Length of Tilt Control: Length required to make operation convenient from floor level.
3. Tilt: Full.

H. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

I. Valance: Two slats

1. Finish Color Characteristics: Match color, texture, pattern and gloss of slats.

J. Mounting: Head mounted, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

K. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range.

2.2 HORIZONTAL LOUVER BLIND FABRICATION

A. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Blind Units Installed between (inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.

C. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

F. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 15010

GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE OF DIVISION

A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning mechanical installation in accordance with all applicable codes, and contract drawings and specifications. Work shall include all work specified in Division-15 Mechanical, Section numbers 15000 through 15999.

B. Pay for all required licenses, fees, inspections and permits.

1.3 RELATION TO OTHER WORK

A. Work Not in Division-15: Related work not included in this division consists of requirements given in the following as may be included in the contract documents:

1. Other divisions which may include work (such as concrete, steel, painting, ceiling systems, structure and other work) related to the work of Division-15.

B. Work of Division-15: Any or all sections of Division-15 may include a paragraph or paragraphs under the heading, "Relation to other Work". Where such a paragraph is indicated and work directly related to the section is listed or described, such work shall be considered as relating directly to the indicated section. Any related work (directly related or otherwise) which may be omitted by reference from the "Relation to Other Work" paragraph of such section(s), shall be provided as necessary and required whether or not such work is included by reference. Such listing or description of related work within a section is given only as a convenience to the Contractor; omission of other related sections or described work does not in any way exclude the provision of such work.

1.4 CODES

A. Install all work in accordance with the latest edition of all applicable regulations and governing codes, including the regulations of the utility companies serving the project.

B. Where a conflict in code requirements occurs the more stringent requirement shall govern.

1.5 STANDARDS

A. All equipment and devices shall bear U.L. label, the label of an industry recognized approved testing agency or A.G.A. certification for said item of equipment or device.

B. All electrical devices must be U.L. approved.

1.6 DRAWINGS

A. Architectural and structural drawings take precedence over mechanical drawings with reference to the building construction. Mechanical drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between diffusers, registers, lighting fixtures,

equipment, electric panels and devices, plumbing fixtures, and other items which remain exposed in the completed building. Exact locations and arrangement of materials and equipment shall be determined, with the acceptance of the Architect/Engineer, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on Architectural drawings and not by scaling drawings.

1.7 DISCREPANCIES

A. In case of differences between drawings and specifications, or where drawings and specifications are not clear or definite, the subject shall be referred to Architect/Engineer for clarification and instructions.

1.8 ELECTRICAL PROVISIONS

A. Work of Division-15 shall include the electrical requirements which are indicated to be integral with mechanical work and which can be summarized to include (but not necessarily be limited to) the following:

1. Motors.
2. Motor starters.
3. Wiring from mechanical equipment to electrical work termination (junction box or disconnect switch).
4. Control switch, pilot lights, interlocks and similar devices.
5. Electrical heating coils and similar elements in mechanical equipment.
6. Electrical work specified in Division-15 for the HVAC control system.
7. Drip pans to protect electrical work.

B. Motors, Starters, Switches: Provide with all motorized mechanical equipment unless otherwise indicated.

C. Drip Pans: Where possible, do not run mechanical piping directly above electrical (or electronic) equipment which is sensitive to moisture; otherwise provide drip pans under mechanical piping. Locate pan below piping, and extend 6" on each side of piping and lengthwise 18" beyond equipment. Fabricate pans 2" deep, of reinforced sheet metal with rolled edges and soldered or welded seams; 20 gage copper, or 16 gage steel with 2 oz. zinc finish hot dipped after fabrication. Provide 3/4" copper drainage piping, properly discharged.

D. Motors: Unless specifically specified otherwise in the section covering the driven equipment (or the equipment drives), motors shall comply with the following:

1. Three Phase: NEMA design B, three-phase, squirrel cage induction type designed for 1800 rpm synchronous speed for operation in 40^{o}C ambient at 1.15 service factor at constant speed on the scheduled voltage. Motors shall be insulated with Class B insulation material and shall be cast iron, drip proof, horizontal foot mounted type with ball bearings. Two speed motors shall be provided as scheduled and shall be two winding type.
2. Single Phase: Squirrel cage induction type designed for 1800 rpm synchronous speed for operation in 40^{o}C ambient at 1.15 service factor at constant speed on the scheduled voltage. Motors shall be insulated with Class B insulation materials and shall be two winding capacitor start type with steel enclosure, drip proof, horizontal foot mount and ball bearings.
3. Electric motors which are designated to be high efficiency type shall also comply with the section describing high efficiency motors.

E. Scheduled Horsepower: The horsepowers scheduled or specified are those nominal sizes estimated to be required by the equipment when operating at specified duties and efficiencies. In the case of pumps, these horsepowers are non-overloading and may also include provisions for future planned impeller changes. If the actual horsepower for the equipment furnished differs from that specified or shown on the drawings, it shall be the Contractor's responsibility to insure that proper size feeders, breakers, starters, etc. are provided at no change in contract price.

F. Any TEFC motors shall have Class F insulation.

G. Drip proof protected motors shall have Class B insulation.

H. Manufacturer: Electric motors, complying with the requirements of this Section and the installation and performance requirements of the plans, by the following manufacturers are acceptable:

1. Reliance Electric
2. Gould Electric
3. General Electric
4. Westinghouse

1.9 ELECTRICAL/MECHANICAL WORK

A. Definitions: Definitions for the purpose of mechanical/electrical control and power coordination are as follows: (Note: The use of the words, "Provide", "furnish" and "install" are intended only for use in describing the coordination indicated by this paragraph and do not necessarily have the same definitions when used outside of the context of this paragraph.) Any items which do not fall within the scope of this paragraph shall be coordinated as individually specified.

1. "Furnish" means to procure an item and to deliver it to the project for installation.
2. "Install" means to determine (in coordination with others as necessary) the appropriate intended location of an item and to set and connect it in place.
3. "Provide" means to both furnish and install.
4. Power Circuit: Circuit which carries main electric power to apparatus to which the power circuit is connected.
5. Control Circuit: Circuit which carries electrical signals directing the performance of a controller but which does not carry the main electric power. (See NEC, Section 430-71.) Such circuits shall also include those which serve a dual control and power function (e.g., a line voltage thermostat circuit which both activates and powers a small fan motor).
6. Controller: A device, or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)
7. Control Device: A device which reacts to an operating condition (pressure, temperature, flow, humidity, etc.) and which initiates transmission of an electrical control signal which causes operation of a controller or which causes operation of pressure switches, etc.
8. Auxiliary Control Device: A device (such as a low voltage control transformer, electric relay, etc.) which is located in a control circuit and which carries or responds to (but does not initiate) an electrical control signal initiated by a control device.

B. Work of Division-15 includes (but is not necessarily limited to):

1. Provide:

a. All controllers which are generally manufactured or shipped as integral with Division-15 equipment (such as starters packaged with air cooled chillers, etc.).
b. All electric motors and other electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.) which are specified in Division-15.
c. All control circuits (including conduit and boxes) from the Division-16 panels to point of use including the necessary circuit breakers.
d. All other control circuits, including conduit and boxes.
e. All control connections to equipment.
f. All control connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
g. Auxiliary control devices.
h. All control devices (thermostats, pressure switches, flow switches, humidistats, etc.) and make control circuit connections thereto.
i. Any and all pneumatic and electronic and electric control devices and electric or pneumatic connections thereto.

2. Furnish:

a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-15 equipment (such as centrifugal chiller starters which are matched with the chillers but are not physically an integral part of the chiller assembly.)

C. Work of Division-16 includes (but is not necessarily limited to):

1. Provide:

a. All power circuits, including conduit and boxes.
b. All power connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
c. All remote motor disconnects (remote from the related controller) at all locations required by NEC and connections thereto except those disconnects which are specified in Division-15 to be provided as part of the equipment itself.
d. All controllers (except those which are generally manufactured or shipped as separate but companion items to Division-15 equipment such as centrifugal chiller starters).

2. Install:

a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-15 equipment (e.g., chiller starters).

1.10 AUXILIARIES AND ACCESSORIES

A. Include all auxiliaries and accessories for complete and properly operating systems.

1.11 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise Architect/Engineer of discrepancies or questions noted before bidding.

1.12 ASBESTOS

A. Should asbestos, or any other hazardous waste material, be encountered during the execution of the work, or should the presence of asbestos or any other hazardous material

be suspected, immediately notify the Owner and suspend all work in the affected area. The Owner will activate an assessment study to determine the presence of asbestos, or other hazardous material, and evaluate what condition it is in. Removal of asbestos, or other hazardous material, if required, will be conducted by a qualified Contractor, and will be done under separate contract.

1.13 COORDINATION

A. Provide all required coordination and supervision where work of this division connects to or is affected by work of others.

1.14 PROVISIONS FOR OPENINGS

A. Provide all openings required for work performed under Division-15. Provide sleeves or other approved methods to allow passage of items installed under any Section of Division-15.

1.15 INTERRUPTION OF EXISTING SERVICES

A. Any interruption of existing services shall be coordinated in advance with the Owner's Representative. Shutdown time and duration of critical services shall be decided by the Owner. Contractor shall provide shutoff valves at point of tie-in to minimize downtime.

1.16 CLEANING AND PROTECTION

A. Ductwork: Keep the interior of the duct system free from dirt and rubbish and other foreign matter. All fan motors, switches, and other items, shall also be protected from dirt, rubbish and other foreign matter during building construction. Thoroughly clean all components of the ductwork and remove all dirt, scale, oil and other foreign substances which may have accumulated during the installation process.

B. Equipment: All mechanical equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, etc. Any dents, scratches or other visible blemishes shall be corrected and the appearance of the equipment made "like new" and to the satisfaction of the Architect/Engineer.

C. Upon completion, and before final acceptance of the work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.

D. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance. Any materials and equipment which are damaged shall be repaired to "as new" condition or replaced at the direction of the Architect/Engineer. Where factory finishes occur and damage is minor, finishes may be touched up. If, in the opinion of the Architect/Engineer the damage is excessive, factory finish shall be replaced to "new" condition.

1.17 SHOP DRAWINGS

A. Submit shop drawings for all items, services and systems included in the project.

B. Shop drawings shall clearly show the following:

1. Technical and descriptive data in detail equal to or greater than the data given in the item specification. Indicate all characteristics, special modifications and features. Where performance and characteristic data is shown on the drawings or specified, submitted data shall be provided in a degree which is both quantitatively and qualitatively equal to that specified and shown so that comparison can be made.

Present data in detail equal to or greater than that given in item specification and include all weights, deflections, speeds, velocities, pressure drops, operating temperatures, operating curves, temperature ranges, sound ratings, dimensions, sizes, manufacturers' names, model numbers, types of material used, operating pressures, full load amperages, starting amperages, fouling factors, capacities, set points, chemical compositions, certifications and endorsements, operating voltages, thicknesses, gauges and all other related information as applicable to particular item.

2. Exceptions to or deviations from the contract documents. Should Architect/Engineer accept any items having such deviations which are not clearly brought to Architect/Engineer's attention, in writing, on item submittal, then Contractor is responsible for correction of such deviations regardless of when such deviations are discovered.

C. Additional Requirements: See specific sections of the Specifications for any additional requirements.

1.18 SHOP DRAWINGS TECHNICAL INFORMATION BROCHURE

A. Submit within thirty days after Notice to Proceed. Each brochure shall consist of an adequately sized, hard-cover, 3-ring binder for 8-1/2" x 11" sheets. Provide correct designation on outside cover and on spine of binder, i.e., mechanical. All shop drawings shall be submitted at one time; partial submittals will not be accepted.

B. First sheet in the brochure shall be a photocopy of the "Division-15 Index" for these specifications. Second sheet shall be prepared by the Contractor and shall list Project addresses for this Project for Contractor and all major subcontractors and suppliers.

C. Provide reinforced separation sheets tabbed with the appropriate specifications section reference number and typed index for each section.

D. Shop drawing technical and descriptive data shall be inserted in the brochure in proper order on all items. Mark the appropriate specification section or drawing reference number in the right hand corner of each item. Provide complete information, including, but not limited to, wiring and control diagrams, scale drawings showing that proposed substitute equipment will fit into allotted space (indicate all service access, connections, etc.), test data, and other data required to determine if equipment complies fully with the specifications. All typewritten pages shall be on contractor or equipment manufacturer printed letterhead.

E. At the end of the brochure, provide and insert a copy of the specifications for Division-15 and all addenda applicable to this Division.

F. Submit not less than six brochures. Provide separate tag marking on an individual copy for the Owner, Architect, Engineer, Contractor, Subcontractor (two copies).

G. Contractor shall review the brochure before submitting. Submittal information on each item in each brochure shall bear the Contractor's stamp of approval, initials of checker and date checked by him. No request for payment of or substitutions will be considered until brochure has been reviewed by the Contractor and submitted for checking.

1.19 SHOP DRAWINGS FOR PIPING SYSTEMS AND DUCT SYSTEMS

A. Shop drawings for piping systems and duct systems shall be done on reproducible transparencies and shall be of sufficient scale to verify clearances and equipment locations. Shop drawings shall show all required maintenance and operational clearances required. Cost of shop drawing preparation and reproduction shall be borne by the Contractor. Title drawings shall include identification of project and names of Architect,

Engineer, Contractor, subcontractor and/or supplier, date, be numbered sequentially and shall indicate the following:

1. Architectural and structural (as required) backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.

    a. Fabrication and Erection dimensions.
    b. Arrangements and sectional views.
    c. Necessary details, including complete information for making connections with other work.
    d. Kinds of materials and finishes.
    e. Descriptive names of equipment.
    f. Modifications and options to standard equipment required by the contract.
    g. Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's shop drawing stamp imprint).

B. In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where item(s) occur in the contract documents.

C. Also provide shop drawings, using sepias of the architectural reflected ceiling plans, which indicate locations of the following (to be verified by Contractor): Air distribution devices, sprinkler heads, lights and access panels.

D. See specific sections of specifications for further requirements.

1.20 AIR HANDLING UNIT AND DUCTWORK CONFIGURATION SHOP DRAWINGS

A. Contractor shall submit a shop drawing for <u>each</u> air handling unit. Such shop drawings shall meet the following requirements:

1. Be drawn at not less than a scale of 1/4" = 1'-0". Contractor may elect to use a larger scale if he desires (i.e., if drawing of unit is at 1/4" = 1'-0", 1/2" = 1'-0" may be used.).
2. Clearly show all proposed ductwork configuration changes (sizes, routing, and similar differences) which are different in any respect from the Drawings. Extent of shop drawings shall show all ductwork to and from each unit beginning with and terminating at those points where ductwork is intended to remain unchanged as shown on Drawings.
3. Where proposed changes affect any other work such as structure, housekeeping pads, piping, equipment, electrical work or any other work, shop drawings shall clearly show those proposed changes.
4. Proposed changes shall be at no additional change in contract price.
5. Where Drawings show units in plan only, shop drawings shall show proposed units in plan and also in elevation.
6. Shop drawings shall also show exact locations of related work (such as bar joists, columns, beams, sound attenuators, and like items) which affect the proposed ductwork routing and unit location and configuration.
7. Each section of each air handling unit shall be clearly identified (i.e., coil section, fan section, filter section, mixing box section, etc.).

B. Failure to submit these shop drawings together at the same time with the air handling unit shop drawings will result in total disapproval of the proposed air handling units. Time delays or other reasons will not be considered.

1.21 ELECTRONIC FILES

A. CADD files will be available on a limited basis to qualified firms at the Architects prerogative. The cost of the files will be $100 per sheet. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.

1. A request for CADD files should be delivered in writing along with payment for such files. Files will not be processed until payment is received.

1.22 OPERATING INSTRUCTIONS

A. Submit for checking a specific set of written operating instructions on each item which requires instructions to operate. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe operating instructions.

1.23 MAINTENANCE INFORMATION

A. Submit for acceptance Maintenance Information consisting of manufacturer's printed instruction and parts lists for each major item of equipment. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe maintenance.

1.24 MANUFACTURER'S CHECK-OUT

A. Check out by Manufacturer's Representative (for major items of equipment): At completion of construction and after performance verification information as above-mentioned has been gathered, submitted and accepted, provide one copy of this information to the manufacturer's representative. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is operating, and sign a Check-Out Memo for record. Submit a copy of the memo on each major item of equipment for each brochure. Accepted memos shall be inserted on each brochure with the performance verification information and submittal data. Memos shall be submitted and accepted before Instruction in Operation to Owner or a request for final inspection.

1.25 SYSTEM GUARANTEE

A. The work required under Division-15 shall include a one year guarantee. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System. This guarantee shall also include reasonable adjustments of the system required for proper operation during the guarantee period. Explain the provisions of guarantee to Owner at the "Instruction in Operation Conference".

1.26 INSTRUCTION TO OWNER

A. Submit all required items for checking one week before final inspection of the building is scheduled. When all items are accepted and placed in the proper brochures, the Contractor shall give notice in writing that he is ready to give the Owner an "Instruction in Operation Conference". After the above mentioned request is received the Contractor will be notified of the time the conference can be held with the Owner. At the conference, the Contractor shall review with the Owner all appropriate information. At the end of the conference, seven copies of a memo certifying Instruction in Operation and Completed

Demonstration shall be signed by the Contractor, Subcontractor and Owner and one copy inserted in each brochure.

1.27 MATERIALS AND EQUIPMENT

A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.

1. Submittal shall include the name of the material or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect/Engineer to determine that the equipment meets all specification and requirements. If the Architect/Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.
2. Substituted equipment with all accessories installed or optional equipment where permitted and accepted, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense, and Contractor shall so state in his written request for substitution.

1.28 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Materials and Equipment specified in these contract documents are accepted only in regards to general performance and quality. It shall be the Contractor's responsibility to insure that acceptable materials and equipment meet or exceed the efficiencies, capacities, electrical characteristics, performance and quality of the equipment herein specified. Acceptable equipment must also generally conform, without extensive modification of related systems to the accessories, weights, space and maintenance requirements, etc., of the specified equipment. Any modification to related systems of this or other trades shall be made at the Contractor's expense and the Contractor shall be responsible for coordination between trades. Any difference in capacity, efficiency, electrical characteristics, weights or quality of product, etc., between specified materials and equipment and acceptable alternates shall be submitted to the Architect/Engineer for acceptance within 30 days of Notice to Proceed.

PART 2 - PRODUCTS

2.1 Section part not applicable.

PART 3 - EXECUTION

3.1 Section part not applicable.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section, in addition to the following:

1.2 SCOPE

A. Materials listed herein are general mechanical materials to be used under the Division-15 sections of the specifications unless specifically noted otherwise in the particular section or on the drawings.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications. This section relates to all sections of Division-15 as may be applicable to the work of each section.

1.4 STANDARDS

A. Quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society of Testing and Materials.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT, GENERAL

A. All materials and equipment shall be new and without blemish or defect.

B. Equipment and materials shall be products which will meet with the acceptance of the agency inspecting the work. Where acceptance is contingent upon having the products examined, tested and certified by Underwriters Laboratory or other recognized testing laboratory, the product shall be so examined, tested and certified.

C. Where no specific indication as to the type or quality of material or equipment is indicated, a standard item or system shall be furnished with all options, features and capabilities to meet the project requirements.

D. Performance and Capacity:

1. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In some cases equipment may be sized to allow for future requirements or for other reasons which may not be stated on the Drawings or in the Specifications; provide equipment and systems with the capacities, capabilities and features indicated to provide the maximum or minimum (as appropriate) conditions.

E. Operating conditions and capacities must be as follows:

1. No overloading.

2. No operation at conditions outside of maximum and minimum limits recommended by the manufacturer and accepted by the Architect/Engineer.
3. Compatible with all systems.

F. Unless otherwise specified, all equipment and materials furnished must be as follows:

1. Recommended by the manufacturer for the application.
2. Installed in accordance with the manufacturer's recommendations for the application except where specifications and drawings clearly indicate otherwise.

2.2 ACCESS DOORS AND PANELS

A. Locations: Provide access doors and panels (access units) as necessary for access to items which are concealed and which may require service or maintenance or other reason for accessibility. Examples of such items include, but are not limited to, the following: valves, cleanouts, pipe unions, expansion joints and connectors, dampers, coils, junction boxes, duct heaters, terminal units, HVAC control system devices and similar types of items.

B. Access units: Shall be manufactured by the Milcor Division of Inland-Ryerson, Boico, Nystrom or Ventfabrics. Types are as follows (Milcor style designations are used for example only):

Location	Door/Panel Type
Drywall	Style "DW"
Masonry or tile	Style "M-stainless"
Acoustical tile	Style "AT"
Plaster	Style "K"
Fire-rated walls (**or as indicated below)	Style "Fire Rated"**

C. Fire Rated Units:

1. Frame and panel assembly shall bear a U.L. label reading, "frame and door assembly, rating 1-1/2-hour (B), temperature rise 30 minutes 250^{o}F maximum".
2. Have an automatic closing device and mechanism to release the latch bolt from the inside.
3. Acceptable Manufacturers: Boico Style F, Inryco/Milcor Style VA, Nystrom Style APFR.

D. Non-fire Rated Units:

1. Steel panels and frames.
2. Locks and latches shall be as appropriate for the location and shall be cam-lock type latches, flush screw driver operated locks or cylindrical locks.
3. Provide two keys for all doors. All doors shall be keyed the same.

E. Other Requirements:

1. Doors and panels installed in glazed or ceramic tiled surfaces, in toilet rooms or in kitchens shall be stainless steel.
2. Unless otherwise indicated, finish shall be rust inhibitive prime coat.

F. Sizes:

1. Minimum size: 8" x 8".
2. Sizes of each unit shall be individually selected to allow the recommended and required service and maintenance and accessibility functions to be accomplished. These functions shall generally include, for example, valve removal, damper linkage

resetting, control adjustment, lubrication, repair, replacement and similar tasks as may be necessary and recommended for the concealed item.

3. Sizes shall be of the following increments (unless otherwise approved) to allow the accessibility function to be accomplished: 8" x 8", 8" x 12", 12" x 12", 12" x 16", 16" x 16", 16" x 24", 24" x 24", 24" x 36", 30" x 30", 36" x 36" or 36" x 48".
4. No size smaller than 16" x 24" shall be allowed when a person must pass through the access opening in order to accomplish the desired accessibility function.
5. Every attic or furred space in which mechanical equipment is installed shall be accessible by an opening and passageway as large as the largest piece of the equipment and in no case less than 22 x 36 inches continuous from the opening to the equipment and its controls. The opening to the passageway shall be located not more than 20 feet from the equipment measured along the center line of such passageway.

2.3 PAINTING AND MARKING

A. All paint and materials used for painting shall be manufacturer's "first quality" product. For additional paint material requirements, refer to Section 09900, Painting.

B. Marking: Refer also to sections describing identification of mechanical systems.

2.4 PIPE HANGERS AND SUPPORTING DEVICES

A. General: Refer to other sections of Division-15 for any requirements which may be additional to this section. Comply with the more stringent requirement if more than one method is specified or shown.

B. Pipe supporting devices specified herein shall apply to all Division-15 piping unless modified in subsequent sections of Division-15 (ie., vibration isolation) or detailed on the drawings.

1. Pipe hangers for copper pipe shall be copper or copperplated and for steel pipe shall be zinc-plated, clevis type hangers.
2. Hangers for pressure piping shall be clevis type or accepted as equivalent. Pipe hangers shall be capable of vertical adjustment after erection of the piping. Piping shall not be hung from fire and/or smoke walls.
3. Vertical piping supports shall be constructed of carbon steel with rounded ears and two or four holes for clamping bolts. Steel, galvanized and cast iron piping riser clamps shall have galvanized finish. Copper and brass piping riser clamps shall have electro-plated copper or PVC coating finish.
4. Acceptable Manufacturers are Grinnell, PHD Manufacturing Inc., Fee and Mason, Michigan and Elcen.

C. Beam clamps may be used when supporting piping from steel structures.

D. Concrete inserts shall be placed in forms as work of Division-15 prior to the time that concrete is poured.

E. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of a concrete slab.

F. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.

G. Powder set type fasteners or inserts shall not be used.

2.5 FLOOR, WALL OR CEILING PLATES OR ESCUTCHEONS IN EXPOSED AREAS

A. Shall be chrome-plated. Escutcheons for extended sleeves shall be of the type designed for that purpose. Split ring escutcheons will not be allowed.

B. Escutcheons to be as manufactured by Guarantee Specialty Mfg. Co., Cleveland, Ohio; American Sanitary Mfg. Co., Abingdon, Ill., or Beaton Cadwell.

C. Provide escutcheons or fabricated plates or collars at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equivalent to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equivalent to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18 gage galvanized copper bearing sheet steel, secured to structure and neatly fitted around duct or pipe.

2.6 SLEEVES

A. General: Lay out work and set sleeves in new or existing construction so that minimum cutting, drilling and patching is required. Seal all sleeves not used during construction period with grout. Seal unused penetrations and sleeves through fire rated barriers to prevent passage of smoke and heat using an Underwriters' Laboratories approved method; sealing method must be rated at least equivalent to the barrier being penetrated. Submit proposed method to show proof of UL approval.

B. Pipe Sleeves, Special Considerations: The following conditions require pipe sleeves as indicated:

1. Where subject to hydrostatic pressure: Sleeves installed in walls and floors subject to hydrostatic (water) pressures shall be "Link Seal" (Thunderline Corp) Type WS or accepted as equivalent.
2. Where piping is existing: When fire rated walls are to be erected where there is existing piping, provide Proset fire rated split wall system pipe sleeves, or accepted equivalent.
3. Where penetration is part of air duct or plenum system: Do not use plastic pipe for sleeves where floor being penetrated is part of an air plenum so that no fire or smoke hazard is introduced by use of plastic.
4. Where penetration is through fire rated barriers: Provide mild steel sleeves for penetrations of fire rated barriers.

C. Pipe Sleeves in Walls and Partitions:

1. Sleeves Above Grade: Use schedule 40 mild steel pipe or schedule 80 CPVC pipe. Provide sleeves built into wall, partition or beam of size to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve.
2. Sleeves Below Grade in Exterior Walls: Schedule 40 steel hot dipped galvanized after fabrication or cast iron sleeve with not less than 1/4-inch x 3-inch center flange (water stop) around the exterior face of the wall.
3. Penetrations of fire rated barriers shall have only mild steel sleeves; plastic is not allowed.

D. Pipe Sleeves in Floors Above Grade: Use schedule 40 mild steel pipe or schedule 80 CPVC pipe. Provide sleeves built into wall, partition or beam of size to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve. Set sleeves before floor is poured; extend not less than ½-inch above finished floor.

E. Pipe Sleeves in Floors on Grade: Sleeves shall be Schedule 40 steel or Schedule 80 CPVC plastic. Set sleeves before floor is poured. Size sleeves to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve. Extend sleeve not less than ½ inch above finished floor.

F. Duct Sleeves: Sleeves or openings sized to pass mechanical ducts and covering shall be of framed steel construction in roof, wall, and partitions.

G. Sealing of Sleeves:

1. Pipe Sleeves Below Grade and On Grade: Caulk annular space between pipe and sleeve using approved caulking material to a minimum one inch deep. Result shall be a water tight and vermin proof penetration.
2. Pipe and Duct Sleeves Above Grade: Openings around pipes, ducts and other conduit passing through sleeves shall be made draft free and vermin-proof by solidly packing with mineral wool or fiberglass or by other such approved method.
3. Pipe and Duct Sleeves Through Fire Rated Barriers: All penetrations through fire rated barriers (both walls and floors) shall comply with Division-07 or be as specified in this Division.

2.7 FIRE/SMOKE RATED FLOOR, PARTITION OR WALL PENETRATION SEALANT

A. Seal shall be composed of fire barrier product, putty, or caulking materials used either in combination or singularly. Acceptable Manufacturers are 3M Corporation or Dow Corning.

2.8 EXCAVATION AND BACKFILL

A. Provide as necessary to accomplish work specified. Perform in accordance with applicable State and Local codes and accepted good practice and in accordance with other applicable sections or divisions.

2.9 BELT DRIVES

A. General: Equip each motor driven machine not direct connected with V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves and shall be carefully matched for each drive. Sheaves shall be cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. The rating of each drive shall be as recommended by manufacturer for service but shall be at least 1.5 times nameplate rating of motor.

B. Speed Adjustment: Adjust fan speed by change(s) in sheave size as necessary to obtain proper design air flow with fan in its installed location. Fans may be first fitted with variable pitch drives until proper speed adjustment is made and then fitted with proper fixed pitch drive size, or alternate sizes of fixed pitch drives may be used until proper fan needed to deliver necessary air quantity.

C. Vibration of Air Handling Equipment and Fan Units: For air handling equipment and fans driven by motors 5-hp or greater, field vibration levels will not be acceptable if the maximum vibration velocity or displacement measurement exceeds the following values (when measurements are taken at the bearing supports using a vibration analyzer with the filter set at the operating fan speed):

Fan Speed (RPM)	Maximum Vibration Level
800 or Less	5 Mils (0.127 mm) max. displacement
801 and Greater	0.20 in/sec. (5 mm/s) max. velocity

D. Belt and Coupling Guards: Each belt drive shall be equipped with an OSHA approved guard. Guards shall be constructed of #12 U.S. standard gage 3/4-inch diamond mesh wire screen, or equivalent, welded to one inch steel angle frames, and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal or not less than #18 U.S. standard gage. Braces or supports must not "bridge" sound and vibration isolators. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall also be provided to permit oiling, use of speed counters, and other maintenance and testing operations with guard in place. All direct drive equipment shall have coupling guards in accordance with Florida Department of Business Regulation safety regulations and OSHA.

2.10 BEARINGS

A. All bearings shall be 200,000-hour rated unless otherwise specified.

PART 3 - EXECUTION

3.1 EQUIPMENT ACCESS

A. Access Doors and Panels:

1. Locations: Provide access unit at the following locations.

a. Where additionally specified in other sections of this Division-15 and where specifically indicated on the drawings.
b. Where not specifically indicated on the drawings but where the work to be provided will require accessibility for purposes as described or as recommended by the manufacturer of the concealed item.
c. At all locations where concealed equipment, fixtures, devices and similar items require accessibility for service, inspection, maintenance, repair, replacement and where such concealed item would not otherwise be accessible for such functions without the provision of an appropriately sized access unit.

B. Installation:

1. Definitions: For the purpose of coordination of responsibility, the following words are defined to describe the intended coordination.

a. "Furnish" means to procure an item and deliver it to the project for installation.
b. "Install" means to determine (in coordination with others as necessary) the intended appropriate location of an item and to set, connect and otherwise fix in place in a manner to allow intended operation and use.
c. "Provide" means to both furnish and install fully and completely in all aspects.

2. Furnishing Access Units: Access units shall be furnished as work of the Division which governs the item which is intended to be made accessible by the access unit.
3. Installing Access Units: Access units shall be installed as work of the Division which governs the surface, barrier, partition or other building component in and on which the access unit is to be placed.
4. Determination of Locations:

a. Where the work of Division-15 requires that the access unit be provided (i.e., both furnished and installed), then the responsibility for determination of the location at which the access unit is to be placed is also work of Division-15.
b. Where the work of Division-15 requires that access unit be furnished for installation as work of another Division, then the responsibility for determination of the location at which the access unit is to be installed shall be work of Division-15.

Conversely, where the work of one Division requires that an access unit be only installed, then the responsibility for determination of the location of which the access unit is to be installed shall be work of Division-15 which furnishes the access unit.

5. Determination of Sizes:

   a. Unless an access unit size is indicated on the drawings or otherwise specified, the size of each access unit shall be determined as work of the Division which either provides or furnishes the access unit.
   b. Sizes for access units which are provided or furnished as work of this Division shall be in compliance with sizing criteria of this Division.

3.2 PAINTING

A. Paint all exposed piping, insulation, equipment, structural bases, racks, in equipment rooms and on roof, furnished under Division-15 of these specifications. All exposed metal surfaces shall be given one prime coat and two finish coats. All insulated surfaces shall be given one sizing coat of glue sizing (omit this step if factory applied finish is suitable to receive prime coat), one prime coat and one finish coat. Factory painted or finished items do not require field painting but shall require "touch-up" with matching paint or finish where scratched.

B. Pipe hangers, saddles, supports, riser clamps and accessories shall be painted to match their piping.

C. Equipment not completely accessible for painting when set in place shall be thoroughly cleaned and painted before installation and suitably protected.

D. Piping concealed need not be painted.

3.3 HANGERS AND INSERTS

A. Refer also to other sections which may describe additional requirements for hanging and supporting. Comply with the more stringent requirement if more than one method is specified or shown.

B. Provide and properly locate hangers to adequately support piping and equipment. Arrange hangers to permit expansion and contraction.

C. The size of hanger for non-insulated pipes shall be suitable for pipe size to be supported. For insulated piping, the size of the hanger shall be suitable for the pipe size, plus the insulation and a 16-gauge half-circle galvanized sheet metal insulation saddle.

D. Isolation of copper pipe from steel hangers to consist of wrapping pipe at, and 1" each side of contact surface with not less than two layers of adhesive type plastic electrical insulating tape.

E. Pipe supports for piping 2" diameter and below may be supported directly from Epicure steel decking using Epicure standard hangers (200 lb. max. load). Piping above 2" shall be supported from steel beams.

F. Locate pipe supports as follows unless noted in other sections of these specifications or on the drawings:

   1. Horizontal cast iron pipe inside building - supported on each length of pipe.
   2. Vertical cast iron pipe inside building - supported at each floor level and at the base.

3. Horizontal steel piping and copper tubing 1" diameter and under - support on 6' centers.
4. Horizontal steel piping and copper tubing above 1" through 1-1/2" diameter - support on 8' centers.
5. Horizontal steel piping and copper tubing larger than 1-1/2" diameter -support on 10' centers, except 24" diameter piping shall be supported by main roof beams (20' O.C. maximum).
6. Support vertical cast iron, steel and copper piping at each floor penetration not to exceed 20 foot intervals.

3.4 ANCHORS

A. Install a suitable anchor on piping to prevent movement from expansion and contraction by welding or clamping securely to pipe at fitting or coupling. Approval of the Architect/Engineer of method of anchorage must be obtained before installation of work. Properly anchor piping to remove strains on equipment which would be caused by expansion and contraction. Adequately insulate anchors on piping, with operating fluid temperatures below 75^{o}F, to prevent moisture condensation problems.

3.5 EXPANSION AND CONTRACTION PROVISIONS

A. Piping is designed with offsets and loops to provide for expansion and contraction. At such points, piping shall be cold sprung to equalize expansion when at operating temperatures. Install piping to maintain grade at all operating temperatures.

3.6 FLASHING

A. Flashing shall be done as work of other divisions.

3.7 SLEEVES FOR PIPING

A. Provide sleeves for all piping where pipe penetrations in walls, floors or other building structure are required. Sleeves in poured concrete shall have water tight seams and joints.

B. Extend sleeves through walls, partitions and ceilings to finished surface. Extend sleeves through finished floors to not less than 1/4 inch above finished surface. Extend sleeves in concrete floors in chases to not less than 1 inch above floor top surface. Sleeves installed above finished ceilings as part of fire/smoke rated wall assemblies shall extend not less than 1" beyond both wall faces.

C. Provide sleeves of adequate size to permit clearance for pipe movement and proper grading and sloping of pipes. Provide sleeves for insulated pipe of adequate size to clear insulation.

D. Caulk space between sleeve's inner surface and pipe's outer surface (including insulation surface if pipe is insulated) with approved with fire rated safing material. Provide flexible fire retardant sealant if pipe is subject to expansion or contraction. Final result shall be an approved fire and smoke stop at pipe and sleeve assembly.

E. Sleeves in walls and slabs subject to hydrostatic pressures shall be water tight at twice the hydrostatic pressure expected to be encountered at the location of the penetration.

3.8 SLEEVES FOR DUCTWORK

A. Ductwork sleeves shall be provided in accord with current SMACNA recommendations or as otherwise detailed on Drawings. Refer also section describing duct systems.

3.9 ESCUTCHEONS

A. Provide chrome plated brass escutcheons (for 1/4 or 1 inch projecting sleeves as required) at each point where an uninsulated pipe passes thru a finished surface.

3.10 CONCRETE BASES AND STRUCTURAL STEEL

A. Concrete bases and structural steel to support equipment and piping installed under each specification section or division and not specifically shown on the structural or architectural plans shall be furnished for this work.

3.11 SEALANT

A. Fire/smoke sealant shall be installed in strict compliance with the manufacturer's installation instructions.

END OF SECTION

SECTION 15056

HOUSEKEEPING PADS, CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide concrete housekeeping pads for the equipment listed in this section. This work shall be performed by the concrete installer.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the drawings and specifications.

B. This section directly related in particular to sections (which may or may not be included in this division) which describe the following:

1. Concrete described in other divisions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All concrete and steel for concrete housekeeping pads shall comply with those sections of the specification division describing concrete and steel.

2.2 HOUSEKEEPING PADS

A. Provide reinforced (#4's @ 12" both ways with 1-1/2" top cover) concrete housekeeping pads for each individual machine. Pads shall extend six inches beyond the machine bases in all directions and be continuous beneath the machine. Pads shall have chamfered edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the machine.

B. Coordinate exact length and width of each pad and any penetrations which may be necessary for piping or conduit with the actual equipment approved for use on the project.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to the section describing vibration isolation for equipment which is to rest on concrete housekeeping pads.

3.2 PAD HEIGHTS

A. Provide 6" high concrete pads for the following:

1. All equipment specified or shown to be on a concrete pad if no height is given.
2. Indoor air handling units.
3. Domestic water heaters.

END OF SECTION

SECTION 15060

PIPING SYSTEMS: HVAC, WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide systems as indicated and include all offsets, fittings, sleeves and similar items required (but not indicated due to drawing scale) for complete and operable systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division-15 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Valves, cocks and specialties.
2. Thermometers, gauges and flow meters.
3. Insulation.
4. Connected equipment.

1.4 SHOP DRAWINGS

A. Refer to the Section entitled "General Mechanical Provisions".

1.5 INDUSTRY STANDARDS

A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

1.6 PRESSURE AND TEMPERATURE RATINGS

A. Temperature: Unless otherwise specified, ratings shall be at 150^{o}F for the chilled and condenser water systems and 200^{o}F for the hot water system for all components specified herein.

B. Pressure: Unless otherwise specified, all components must be of pressure class and rating to be recommended for operation at the maximum allowable non-shock pressure of 200 psig.

1.7 FLUIDS

A. This section covers the following fluids:

1. Chilled water.

PART 2 - PRODUCTS

2.1 GENERAL

A. Application: Piping systems shall be of the materials indicated.

B. Quality and Weight: Materials shall comply with requirements and specifications of the appropriate standards of the American Society for Testing and Materials.

2.2 STEEL PIPE AND FITTINGS

A. Pipe: Black steel, seamless or electric weld for pipe sizes two (2) inches and above, continuous weld below two (2) inches, conforming to ASTM Std. Spec. A-53 or A-120. Schedule 40 to 10"; 0.375" wall thickness for 12" and greater.

B. Fittings:

1. General: Be wrought steel socket welded or threaded, or wrought steel butt welded, rated to match the schedule of the connected pipe.
2. Screwed Fittings: Malleable iron, ASTM A-47. Unions shall be 250 lb. (maximum) ground joint type. All couplings, regardless of size shall be taper tapped; i.e., couplings 2 inches and smaller shipped with pipe are not acceptable for use in the piping system.
3. Welded Fittings: Forged, seamless, black steel, long radius, conforming to ASTM Std. Spec. A-234. Weldolet fittings may be used in lieu of forged tees where branch connections are not larger than three-quarters the size of main pipe. Use groove or ridge type welding rings on all piping over 4-inch diameter. Mitre elbows, tees and reducers are prohibited.

2.3 COPPER PIPE AND FITTINGS

A. General: Comply with ASTM A-88. Copper is allowed for pipe sizes only up to and including 4-inch diameter.

B. Pipe and fittings (½-inch OD and less): Type L soft drawn tubing with flare fittings.

C. Pipe and Fittings (up to 4-inch diameter): Type L, hard drawn, ASTM-B88 with wrought or cast brass solder joint fittings.

2.4 UNIONS, FLANGES AND DIELECTRIC INSULATORS

A. Unions: Use ground joint unions on piping 1-1/2" and smaller, and flanged unions on sizes 2" and larger. Use malleable iron on steel piping black or galvanized as specified for piping. Unions in copper piping shall be brass.

B. Flanges: Forged carbon steel, welding neck type conforming to ASTM Std. Spec. A-181 Grade 1. Flanges shall have raised face and gaskets conforming to ANSI B16.5.

C. Dielectric Isolators:

1. Dielectric Unions: Are to be used at all junctions of copper pipe and steel equipment. Use flanged type insulated unions in piping 1-1/2" and larger with screw or solder joint connections to suit pipe and equipment. Epco, Capitol Manufacturing and Supply Co., Patrol Valve Co., or approved equal.
2. Dielectric Flanges: For pipe sizes two and one-half inches and over; Plico Products, flanged insulation sets with; phenolic retainer, nitrile rubber seal element, polyethylene sleeves and double washer sets.

2.5 PIPE NIPPLES

A. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

PART 3 - EXECUTION

3.1 GENERAL

A. Routing and Placement: Piping shall be run without traps or pockets and pitched 1" in 40' in the direction of flow. Interior piping shall be run parallel to the walls and ceilings in a neat manner and shall be offset as required to avoid interferences with structural or architectural features and other work. Exterior piping (above and below grade) shall essentially be routed and located as indicated on the drawings; however, actual placement shall be verified by confirming exact location of structures and other utilities in the field and by careful layout prior to execution of the work. Drawings are generally diagrammatic and do not show every bend, off-set, elbow or other fitting required in the piping for installation in the indicated location. Coordinate installation so that no conflicts or interferences are created with other piping, equipment or other work.

B. Run all lines parallel or perpendicular to building lines and with a minimum of joints and fittings. Avoid diagonal runs where possible.

C. Insulated Piping: For piping requiring insulation, install piping with sufficient clearances to permit proper application of the insulation.

3.2 APPLICATIONS OF PIPING SYSTEMS

A. General: Piping systems may be installed as steel or copper systems of the materials specified. These systems may be installed as combinations of steel and copper providing the appropriate dielectric isolators, methods of joining, compliance with maximum and minimum allowed sizes, and other requirements are provided.

3.3 EXPANSION AND CONTRACTION

A. Piping shall be installed with provisions for expansion both horizontally and vertically in all long runs including runouts from risers. Essentially the provisions shall take the form of expansion loops or expansion elbows, as indicated on the drawings; however, in certain portions, where indicated, these provisions may take the form of expansion connectors as specified in other sections.

3.4 JOINTS AND CONNECTIONS

A. General:

1. Correctly align all pipe before joints are made.
2. Joints in copper piping shall be made with 95-5 solder and flux.
3. Joints and connections shall be made permanently air, gas and water tight.

B. Welded Joints: All pipe 2-1/2" and larger shall be welded. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Bevel ends of pipe and, after carefully aligning and setting of proper weld gap, tack weld to secure pipe and fittings in true alignment. All weld shall be of sound metal with tack welds removed in advance of finish weld.

C. Welder Certification: All welding shall be performed by welders certified in accordance with ANSI B31.1 with test conducted by the National Certified Pipe Welding Bureau or by other approved testing laboratory. Copy of certification shall be available at job sites. Welders shall show certification certificates to inspector at or prior to time welder is assigned to job. If work of welder is not satisfactory to the inspector, recertification will be required.

D. Welding Rings: Provide welding rings for all butt welded joints.

E. Screwed Joints: Shall be used on steel pipe two (2) inches and smaller except where flanged connections to equipment or valves are required. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Cut a complete thread, using sharp dies properly set and centered, while applying oil graphite cutting lubricant. Use non-hardening compound or tape on male threads only at each joint and tighten joint to leave not more than 3 threads exposed. Provide American Standard Thread screwed joints.

F. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

G. Dissimilar Metals: Where incompatible piping system materials come in contact (except for the use of valves), isolate the two materials with dielectric isolators.

3.5 EQUIPMENT CONNECTIONS

A. General: Make connections between any piece of equipment and any piping system in this Section of the Specifications by means of unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance. Connections to equipment shall be made in accordance with details on the drawings and the equipment manufacturer's installation instructions. Final connections to equipment shall be made with unions for pipe sizes two (2) inches and under and as otherwise noted below for pipe sizes over two inches.

B. Pumps, Valves, Strainers and Other Equipment: Connections shall be made using flanges and bolt and gasket sets to suit the individual pieces of equipment and insure ease of service access.

3.6 BRANCH AND RISER ISOLATION

A. Valves: Provide valves to isolate each riser and branch line.

3.7 PIPE SIZE REDUCTIONS AND ENLARGEMENTS

A. Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal piping shall be made with eccentric reducers. Top of piping shall be flat for venting.

3.8 VALVES

A. General: All valves, balancing cocks and similar items shall be installed in an easily accessible location. Provide access panels for all concealed valves. Where butterfly valves are used, they shall be installed between properly spaced flanges, then run to the full open position before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion.

B. Install valves or cocks in supply and return lines to each piece of equipment on piping main side of union connections.

C. Install valves in horizontal piping with the valve stem in the vertical upright position.

D. Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

3.9 AIR VENTS AND DRAINS

A. Vents and drains shall be provided where shown on the drawings, and at all high and low points, respectively, in the system. Provide ball valves (3/4") with hose thread connector (adapter) at each vent and drain point.

3.10 INSTRUMENTATION AND SPECIALTY ITEMS

A. Thermometers, gauges, gauge cocks, gauge valves, instrument wells, flow stations, flow switches, control valves and similar items which may be specified in other Sections shall be installed complete, including the provision of standard pipe fittings as may be required, as work of this Section. Installation of these items shall be in strict accordance with the manufacturer's installation instructions.

3.11 FLOW INDICATING AND/OR BALANCING VALVES OR METERS

A. Install flow indicating balancing valves where shown on drawings. The locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement and shut-off relative to a specific piece of equipment or portion of the system and not in the exact physical location of the device. The exact physical location shall be determined using field measurements relating to upstream and downstream clearances. Install in accordance with manufacturer's recommendations including increases or decreases in pipe size at points of installation together with minimum recommended lengths of straight run pipe before and after points of installation. Balancing shall be done as work of the section describing test and balance.

3.12 PRESSURE RELIEF VALVES

A. Install pressure relief valves where specified or indicated on the drawings. Pipe to spill over floor drain or service sink.

3.13 TESTS

A. Prior to insulating and concealing the pipe, apply a water pressure test to all parts of the systems before equipment is connected. Use a hydrostatic pressure of not less than 100 psig or 150% of system operating pressure, test system for a period not less than four hours. There shall be no leaks at any point in the system at this pressure.

B. Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and approved. Make repairs of defects that are discovered as a result of inspection or tests with new materials. Caulking of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.

C. Complete all field testing prior to insulation, wrapping and/or backfill.

3.14 FLUSHING AND CLEANING

A. After final testing, thoroughly flush each piping system with clean water to remove debris. Disconnect all coils and heat exchangers from the system before flushing. Flush all coils and heat exchangers separately to assure that debris does not become lodged in them. Provide temporary valves and drains as required to accomplish flushing.

B. After flushing, thoroughly clean each piping system with appropriate cleanser to remove oil, grease, lacquer, etc. Thoroughly flush each system with clean water after cleaning.

C. Also see section describing water treatment systems for HVAC Systems.

3.15 PROTECTION

A. Paint all uninsulated piping underground except cast or ductile iron or PVC with two coats of asphaltic paint. (Manual wiping is not acceptable.)

B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene film or 15 lb. felt.

C. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

END OF SECTION

SECTION 15062

REFRIGERANT PIPE, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide refrigerant piping systems, complete in all respects, between the system components and connected equipment.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to the Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.1 COPPER PIPE

A. Refrigerant system piping shall be refrigerant grade, dehydrated and sealed, seamless, uniformly dead soft temper.

2.2 FITTINGS

A. Refrigerant grade, wrought copper, long radius, solder joint type.

2.3 SOLDER

A. Silver brazing alloy (Sil Fos) Fed. Spec. AA-S-56ld.

2.4 FLUX

A. Non-corrosive, specifically designed for silver brazing.

2.5 ACCESS VALVES

A. Schrader type designed for use with quick coupler hose fittings and provided with individual cap.

PART 3 - EXECUTION

3.1 PIPE SIZES

A. Refrigerant pipe sizes which may be shown on drawings are nominal. Provide sizes not less than sizes indicated and in compliance with size recommended by the

manufacturer(s) at the connected equipment. Provide change in sizes if such change is in accord with manufacturer's recommendation and with Architect/Engineer's approval. Size piping to maintain minimum velocity of 500-fpm in horizontal lines and 1000 fpm in vertical risers for proper oil return; provide double suction risers and hot gas risers as may be necessary to accomplish this.

3.2 REFRIGERANT SPECIALTIES

A. Refrigerant valves, driers, expansion valves, and similar items shall be provided with each system. Where refrigerant access valves are not furnished by the manufacturer, they shall be field installed to enable charging and checking the system.

3.3 JOINTS AND CONNECTIONS

A. General: All joints and connections shall be made permanently refrigerant tight.

B. Solder Joints: Cut tubing square using tubing cutters, with sharp cutting wheels, so as not to crimp the tubing ends. Remove all burrs using a pipe reamer and taking care not to flare the ends of the tube. Thoroughly clean the outside of the pipe and the inside of the fitting using a fine sand cloth. Apply non-corrosive paste flux to the cleaned surfaces immediately and apply silver solder and heat in accordance with manufacturer's instructions. Use care not to damage equipment or refrigerant specialty items when making up joints (protect from excessive heat).

C. Scale Prevention: During brazing, keep pipe system full of inert gas to prevent scale formation.

D. Mechanical Joints: Where the Contractor uses refrigerant tubing sets, follow the manufacturer's installation instructions explicitly, including the use of special tools, when making up the joints. Where precharged tubing and equipment is provided, do not cut into the system to install access valves.

3.4 HANGERS AND SUPPORTS

A. Refer to other sections describing hangers and supports. Isolate copper tubing from contact with any dissimilar metals.

3.5 EVACUATION AND CHARGING

A. When other than completely factory charged equipment and piping systems are used, they shall be evacuated and charged as follows: Charge the system with dry nitrogen and refrigerant and leak test all joints including factory piping within the units. Repair all leaks by disassembling and remaking the joint. After all leaks are corrected, evacuate the system to an absolute pressure of 0.2" mercury. System shall hold this vacuum for two hours with no noticeable rise in pressure. After passing vacuum test, break vacuum twice using refrigerant and re-evacuate for a minimum of two hours each time. Charge the system in the manner and with the type and amount of refrigerant recommended by the manufacturer and in accordance with accepted refrigeration practice.

3.6 REFRIGERANT PIPING CONDUIT

A. Install any refrigerant piping which is below slab or grade in Schedule 40 PVC piping. Size conduit as necessary to properly install piping. Provide long bend sweeps. Install so that conduit will drain and not trap water. Protect ends of conduit from entry by vermin, insects and water.

3.7 OTHER REQUIREMENTS

A. Arrange piping generally as shown and such that service access is facilitated. Keep refrigerant lines as short and direct as possible with a minimum number of joints. Provide sleeves through floors, walls or ceilings, sized to permit installation of full-thickness insulation; seal air tight after installation of piping and insulation.

B. Provide flexible piping arrangement in hot gas discharge line of compressor. Such arrangement shall consist of a piping loop or similar measure to prevent transmission of objectional vibration.

C. Provide a removable core filter-drier in liquid line. In-line filter-driers are acceptable in individual circuits of less than 10-ton nominal capacity. Provide a full size valved bypass around this filter-drier. Provide shut-off valves to isolate the filter drier while flow is through the bypass and also a shutoff valve in the bypass so that filter-drier can be put into use.

D. Provide a refrigerant charging connection in the liquid line upstream from the filter-drier.

E. Provide a moisture indicating sight glass in the liquid line downstream from the filter-drier. Install in vertical line if possible and a sufficient distance downstream from any valve such that the resulting disturbance does not appear in the glass.

F. Provide a filter-drier with isolating shut-off valves and with valved bypass only if compressor is not equipped with a suction line filter or screen.

G. Keep piping free from traps unless otherwise indicated. Install vertical pipe plumb. Pitch horizontal piping only where slope is desirable.

H. Provide shut-off valves at inlet and outlet to all condensers, receivers and evaporators to permit isolation for service. If possible, use angle valves to minimize pressure drop. Use angle valves in all cases at receivers. Use globe valves only when angle valves are impractical.

I. Provide solenoid valves upright in horizontal lines only, unless their design allows installation in vertical pipe.

J. Where compressor(s) do not have pump down control and the compressor(s) associated evaporator coil(s) do not have bottom suction header connections and the evaporator coil(s) are located above the compressor(s), then loop suction lines(s) to top level of coil to prevent liquid slugging.

K. To prevent erratic operation of thermal expansion valve, provide a suction line trap next to evaporator coil suction outlet with expansion valve bulb located between coil and trap. Provide only in suction lines which are level leaving coil outlet or which rise on leaving coil outlet. Trap not required when evaporator coil outlet suction line drops to compressor or suction header immediately after expansion valve bulb.

END OF SECTION

SECTION 15066

PIPING: CONDENSATE DRAIN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide condensate drain piping from cooling coil drain pans.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Air handling equipment with cooling coils.
2. Insulation.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.1 PIPE

A. Type M hard drawn copper conforming to ASTM Spec. B88.

2.2 FITTINGS

A. Wrought copper, solder joint, pressure type conforming to ANSI B16.22.

2.3 SOLDER

A. Composition SB5 (95/5), Fed. Spec. QQ-S-571d and Class 3 (Sil Fos), Fed. Spec. AA-S-561d, ASTM B32.

PART 3 - EXECUTION

3.1 GENERAL

A. Piping shall be sloped uniformly toward drain, and provided with trap seal having a depth, in inches, equivalent to one and one-half (1-1/2) times the total static pressure of the respective fan system. Traps shall be assembled using elbows and tees with threaded brass plugs to permit cleaning of trap and drain line. Piping shall be installed in a neat manner and shall be not smaller than full size of the equipment drain connection or three-quarters inch (3/4") whichever is larger.

3.2 JOINTS AND CONNECTIONS

A. General: Joints and connections shall be made permanently air, gas, and water tight.

B. Solder Joints: Cut pipe square using cutting tool which does not crimp pipe. Remove all burrs using pipe reamer and taking care not to flare the pipe end. Thoroughly clean the outside of pipe and the interior of the fittings using a fine sand cloth. Apply noncorrosive paste flux to the cleaned surfaces immediately and apply solder and heat, in accordance with manufacturer's instructions, to complete joint.

C. Equipment Connections: Connections to copper drain nipples may be made with solder joints provided care is exercised not to damage equipment, its insulation or finish. Connections to equipment having steel nipples shall be made using screwed to solder adapters with teflon tape applied to male threads prior to assembly.

3.3 ROUTING

A. Unless otherwise indicated, route pipe discharge as follows:

1. Roof Mounted Equipment: To nearest roof drain.
2. Interior Equipment: To nearest floor drain.

3.4 INSULATION

A. Insulate if so specified in section describing insulation.

END OF SECTION

SECTION 15101

VALVES, COCKS AND SPECIALTIES: HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide those valves, cocks and specialties which are required for the HVAC piping systems. These items include, but are not necessarily limited to, the following:

1. Check valves.
2. Ball valves.
3. Cocks and plug valves.
4. Drain valves.
5. Butterfly valves.
6. Backflow preventers.
7. Strainers.
8. Safety valves.
9. Pressure relief valves.
10. Air vents.
11. Flow indicating/balancing valves.
12. Pump suction guide/strainer/elbows.
13. Pump discharge/flow control valves.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division-15 and to all other applicable portions of the drawings and specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Pumps.
3. Insulation.
4. Equipment connected to piping systems in which work of this section is applicable.
5. Air control equipment.
6. Work which is described in Sections 15400 through 15499 which relate to the plumbing systems and which requires valves, cocks and specialties shall be provided in compliance with this Section unless requirements of Sections 15400 through 15499 specifically state otherwise.

1.4 APPLICABLE SYSTEMS

A. These valves, cocks and specialties are intended for application in, but not necessarily limited to, the following HVAC piping systems as applicable to this project.

1. Chilled water systems.
2. Hot water systems.
3. Other related HVAC piping systems.

1.5 VALVES, COCKS AND SPECIALTIES

A. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed in an approved manner and location. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equivalent material and pressure class will be accepted.

1.6 ACCEPTABLE MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Mueller
2. Hammond
3. Crane
4. Powell
5. Walworth
6. Lunkenheimer
7. Stockham
8. Williams-Hager
9. APCO
10. Metraflex
11. ACFR
12. Keystone
13. Centerline
14. Demco
15. Gerand
16. Griswold
17. Aeroquip
18. Dezurick
19. Watts,
20. Maxwell & Moore
21. Bell & Gossett
22. Beaton-Cadwell
23. McDonnell Miller
24. Maid-O-Mist
25. Sarco
26. Armstrong
27. Nibco
28. Jamesbury
29. Taco
30. Wheatley Pump & Valve
31. Conbraco
32. Grinnell
33. McDonald

B. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of the item(s) required.

1.7 INDUSTRY STANDARDS

A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

1.8 PRESSURE AND TEMPERATURE RATINGS

A. Temperature: Unless otherwise specified, ratings shall be as follows for all components specified herein.

1. Chilled water systems: 150°F
2. Hot water systems: 200°F
3. Condenser water systems: 150°F
4. Steam systems:

a. Low pressure (LPS): 275°F
b. Medium pressure (MPS): 300°F
c. High pressure (HPS): 350°F

B. Pressure: Unless otherwise specified, all components must be of pressure class and rating to be recommended for operation at the following maximum allowable non-shock pressure ratings.

1. Chilled water systems: 150 psig
2. Hot water systems: 150 psig
3. Condenser water systems: 150 psig
4. Steam systems:

a. Low pressure (LPS): 150 psig
b. Medium pressure (MPS): 150 psig
c. High pressure (HPS): 200 psig

PART 2 - PRODUCTS

2.1 GATE VALVES

A. None allowed.

2.2 GLOBE VALVES

A. 2-1/2" and Larger: Flanged, iron body, yoke bonnet, bronze trim and disc.

B. 2" and Smaller: Screwed, bronze body, union bonnet composition disc.

2.3 CHECK VALVES

A. Swing type:

1. 3-inches and Smaller: Threaded or solder pattern as applicable, pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check, rough brass body, finished gland nut, regrinding bronze disc.
2. 4-inches and Larger (125 psi maximum working pressure): Flanged pattern, iron body, swing check, renewable brass seat, disc and trim. Types: Crane 373, Powell 559, Walworth M-928F, Lunkenheimer 1790, Stockham G-931.
3. 4-inch and Larger (200 psi maximum working pressure): Flanged brass-ferrosteel body, swing check, renewable brass seat, disc and trim. Types: Crane 39E, Powell 576, Walworth M-970F, Lunkenheimer 323.

B. Wafer Type:

1. 3-inch and Larger: Flanged pattern, globe type, semi-steel body, stainless steel spring, bronze disc and bronze seat ring. Types: Williams-Hager Figure 636; APCO Series 600; Mueller Nos. 105, 107, 109 and 113; Metraflex Series 900.

2.4 PLUG VALVES AND BALANCING COCKS

A. General: Semi-steel, lubricated type, bolted cover or gland, position indication dial, full port, teflon coated plug. Over 6-inches shall have a geared or worm drive operator.

B. 2 inches and Smaller: Screw pattern Powell F-2200, Walworth 1700, ACF R1430.

C. 2-1/2 inches and Larger: Flanged end. Powell F2201, Walworth 1700F, ACF R 1431.

2.5 DRAIN VALVES

A. General: Use only for low pressure drainage service.

B. 2 inches and Smaller: Either threaded or soldered ends, class 125, bronze body, screwed bonnet, rising stem, disc with 3/4" hose thread outlet connect.

1. Threaded Pattern: Crane 410, Stockham B-100.
2. Soldered Pattern: Crane 1320, Stockham B108.

2.6 BUTTERFLY VALVES

A. Pattern: Valves shall be of the threaded lug body type. All valves shall have extended necks for insulation clearance.

B. Body: Semi-steel or cast iron or pattern specified hereinbefore.

C. Disc: Bronze or semi-steel with welded nickel edge, 416 stainless steel shaft, bronze bearings, and Hycar seals.

D. Seat: Hycar, bonded to a rigid reinforcing ring which is held in place by a metal retaining ring. All valves shall be capable of bubble tight shut-off at pressure differentials of 200 psig, and 200 psig dead end shut-off.

E. Operators: Valves 2" through 6" shall have lever type actuator capable of infinite position (or minimum of 10 locking positions) and shall have adjustable memory stop. Valves 8" and larger shall have gear type actuator with chain wheel, hand wheel or crank type operating mechanisms, adjustable opening and closing memory stops, and position indicator. All valves 4" and larger located more than 6'-0" above the floor shall be provided with chain wheel and chain. Provide stem extensions (in addition to insulation clearance extension specified hereinbefore) as required to place operators in an easily accessible location free of interference with adjacent piping, equipment structure, and the like.

F. Manufacturers: Grinnell, Keystone, Center-Line, Demco, DeZurick.

2.7 BALL VALVES

A. 2-1/2 inches and Smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, Class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers; Crane, Hammond, Jamesbury, Nibco, Stockham, and Walworth.

2.8 CALIBRATED BALANCING AND FLOW MEASURING VALVES

A. 1/2" to 2": Globe type providing flow balancing, flow measurement, positive shut off, and drain connection. Balancing valves shall be provided with vernier-type setting with adjustment range through four 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. All metal parts shall be of nonferrous, pressure die-cast, nonporous Ametal Copper Alloy. Valve shall provide accurate flow control regardless of valve orientation. Provide form-fitting polyurethane insulation cover. Design basis Armstrong CBV I. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco, and Preso.

B. 2-1/2" to 6": Globe type providing flow balancing, flow measurement, and positive shut off. Balancing valves shall be provided with vernier-type setting with adjustment range through eight 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. Valves shall be cast iron with brass trim. Design basis Armstrong CBV II. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco and Preso.

C. Provide Owner: One portable differential pressure gauge kit of same manufacturer as valves. Kit shall be housed in a hand-carrying case and shall contain one 0-135" W.C. and one 0-60 foot pressure gauge, 5 foot meter hoses with disconnect ends, positive shutoff valves, operating instructions, and flow versus pressure drop curves for each size valve installed.

D. Calibrated balancing valves shall not be required on devices where pressure independent control valves are installed.

2.9 FLOW CONTROL VALVES, PRESSURE COMPENSATING, ACCESSIBLE

A. Automatic pressure compensating flow control valves which operate as mechanically independent devices on a mechanically based variable orifice principal. Provide where specified and where indicated on piping plans and schematics, to enable the proper flow balancing of systems. Acceptable manufacturers: Griswold, Taco.

B. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within 5% accuracy over an operating pressure differential of at least 14 times the minimum required for control.

C. Control mechanism of valve shall be a self-contained, open-chamber cartridge assembly with unobstructed flow passages to eliminate accumulation of particles and debris. All internal working parts shall be type 300 passivated stainless steel. No plated materials are acceptable.

D. Control valve mechanism shall be accessible for changeout if needed without disconnecting the piping system in which it is installed.

E. Valves shall be available in four pressure differential ranges, with the minimum range requiring less than 2 psi to control flow. Cast iron valve bodies shall be provided with inlet and outlet tappings suitable for connection of instruments for verification of flow rates. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.

F. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4 inch x 2 inch minimum size nipples, quick-disconnect valves (to be located outside of insulation), and fittings suitable for use with companion measuring instruments.

G. Automatic flow control valves shall not be required on devices where pressure independent control valves are indicated.

2.10 STRAINERS

A. General: Y-type.

B. Body: Cast iron, ductile iron, cast or forged steel as required for specified working pressure of piping system.

C. Screen: 315 stainless steel or monel. Free area not less than three times inlet area.

1. Perforations: 1/8" mesh for sizes to 8-inches. 5/32" mesh for sizes 10-inches and larger.

D. Connections:

1. Straight thread and gasket to 2-inch size.
2. Flanged 2-1/2 inches and larger.
3. Solder pattern when used in copper piping systems.

E. Bolted cover in 2-1/2 inch and larger.

F. Gate Valve: On 2-1/2 inch size and larger, provide a gate valve on each strainer cover blowdown connection; gate valve to be full size of blowdown connections.

2.11 SAFETY VALVES

A. General: ASME rated as shown on the drawings and/or required by applicable codes.

B. Manufacturers: Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co.

2.12 PRESSURE RELIEF VALVES

A. One-half (1/2) or three quarter (3/4) inch size, brass, iron or steel, ASME rated.

2.13 AIR VENTS

A. Automatic:

1. 150 psi Working Pressure: Metraflex MV-15, Crane 976, Sarco 13W, Armstrong 1AV.
2. 75 psi Working Pressure: Maid-O-Mist #7, Bell & Gossett #7, Hoffman 79.

B. Manual: Brass manual cock, Crane 700 Series, with hose thread adapter.

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves in horizontal piping with the valve stem in the vertical upright position.

B. Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

3.2 VALVES AND COCKS

A. All valves, balancing cocks and similar items shall be installed in an easily accessible location. Provide access panels for all concealed valves. Where gate valves are indicated on the drawings, the Contractor may, at his option, furnish butterfly valves, provided they are in compliance with these specifications. Where butterfly valves are used, they shall be installed between properly spaced flanges, then run to the full open position before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion.

3.3 PRESSURE RELIEF VALVES

A. Install pressure relief valves where specified or indicated on the drawings. Pipe to spill over floor drain or service sink. Provide pressure expansion device for all valves set for 150-psig or greater.

3.4 SAFETY VALVES

A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

3.5 AUTOMATIC AIR VENTS

A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

3.6 DRAIN VALVES

A. Install drain valves at the base of all water piping risers (both supply and return) and at all low points in the piping system.

3.7 BALL VALVES

A. Ball valves may be installed in lieu of gate valves for all individual fan coil unit supply and return piping 1" and smaller.

3.8 VALVED GAUGE CONNECTIONS

A. Contractor shall provide valved gauge connections at diffuser inlet and pump suction to indicate when cleaning is needed. Install on pump suction inlets, adjust foot support to carry weight of suction piping. Install nipple and shutoff valve in blowdown connection. After cleaning and flushing hydronic piping system, but prior to balancing of hydronic piping system, remove disposable fine mesh strainer.

3.9 CALIBRATED BALANCING AND FLOW MEASURING VALVES

A. Provide flow indicating balancing valves where shown on drawings. The locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement and shut-off relative to a specific piece of equipment or portion of the system and not the exact physical location of the device. The exact physical location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's recommendations relating to upstream and downstream clearances. Install in accordance with manufacturer's recommendations including increases or decreases in pipe size at points of installation together with minimum recommended lengths of straight run pipe before and after points

of installation. Balancing shall be done, using the master meter specified hereinbefore, as work of the section describing test and balance. At the conclusion of the test and balance work the meter shall be turned over to, and shall become the property of, the Owner.

3.10 MECHANICAL ACTUATORS

A. Install mechanical actuators with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, chiller rooms, boiler rooms; and where recommended by valve manufacturer because of valve size, pressure differential or other operating condition making manual operation difficult.

END OF SECTION

SECTION 15130

ELECTRIC MOTORS, HIGH EFFICIENCY TYPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. This Section describes electric motors which are more efficient and have a generally better power factor than standard horizontal drip proof electric motors. These motors require less energy than standard electric motors which do not meet this specification.

B. This specification covers horizontal, 3 phase, integral horsepower, drip proof, squirrel cage induction motors in the NEMA frame sizes through 449.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

1.4 STANDARDS

A. All motors shall be in accordance with NEMA Standard MG1-1978, or the latest revision insofar as it is applicable. Motors shall also comply with the applicable portions of the National Electric Code.

PART 2 - PRODUCTS

2.1 VOLTAGE FREQUENCY

A. Motors through 100 hp shall be rated 230/460 volts with 200 or 575 volts as optional; motors above 100 hp shall be rated 460 volts with 575 volts as optional. Motors will be rated for operation on a 3 phase, 60 Hertz power supply. Refer to Electrical Drawings.

2.2 COORDINATION

A. Where variable frequency drives are used to vary the speed and power consumption of electric motors, such motors must be high efficiency type and must be considered with the actual variable frequency drives which are provided so that optimum matching of variable frequency drive to driven motor is obtained.

2.3 OPERATING CHARACTERISTICS

A. Torques: Motors shall meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA standards for Design B for the ratings specified.

B. Currents: Locked rotor (starting) currents shall not exceed NEMA Design B maximum values for the specified rating. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to the motor components.

C. Efficiency: Motors shall have a minimum and nominal full load efficiency which will meet or exceed the accepted values for industry standards for high efficiency motors when tested in accordance with NEMA test standard MG1-12.53a, IEEE Test Procedure 112, Method B, using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency shall be guaranteed.

D. Power Factor: The power factor for 3600 and 1800 rpm, 3 through 250 hp ratings at full load, at full voltage, shall be a minimum of 85%. Six-pole ratings will be excluded from this requirement.

2.4 SERVICE FACTOR AND AMBIENT

A. Motors shall be rated for a 1.15 service factor in a 40^{o}C ambient.

2.5 INSULATION

A. Motors shall have a full Class B insulation system.

B. Motors shall be dipped and baked in polyester varnish to consolidate the winding.

2.6 FRAME SIZE

A. Horsepower/frame relationship shall conform to the latest NEMA Standard for T frame motors.

2.7 ENCLOSURE

A. Motors shall be drip proof construction.

B. Motor frame and endshields shall be of cast aluminum construction using alloys with low copper content.

2.8 BEARINGS

A. All motors shall have anti-friction bearings, sized for a L-10 life of at least 125,000 hours L-10 life for a direct connected load.

B. Aluminum endshields shall have a cast-in steel or cast iron bearing insert.

C. Bearing housing shall be regreasable with provisions for purging old grease.

D. Bearings shall be preloaded with a bearing loading spring to minimize noise and increase bearing life.

2.9 OTHER REQUIREMENTS

A. Conduit Box shall be diagonally split and rotatable in 90 degree increments.

B. External hardware shall be plated to resist corrosion.

C. External paint shall withstand industrial environments.

D. Nameplates shall be of stainless steel or aluminum and stamped per NEMA Standard MG1-10.37. Nameplate information shall include the nominal efficiency value per Standard MG1-12.53b and the manufacturer's minimum guaranteed efficiency value.

2.10 SHOP DRAWINGS

A. In addition to shop drawing requirements of the section entitled, "General Mechanical Provisions", provide motor data including horsepower; rpm; frame size; nominal efficiency and nominal power factor at full load, 75% load and 50% load; guaranteed efficiency and guaranteed power factor at full load, 75% load and 50% load.

PART 3 - EXECUTION

3.1 MOTOR LOCATIONS

A. Provide high efficiency motors for the following as provided on this project:

1. Motors for new pumps.

END OF SECTION

SECTION 15151

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this Section.

1.2 SCOPE

A. Provide all angles, brackets, clamps, anchors, inserts, rods, braces, frames, hangers nuts and bolts, and other miscellaneous steel and hardware items as may be required for the proper support of equipment, piping systems, HVAC systems, plumbing systems and fire protection systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Duct systems.
3. Equipment items.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Provide specific data on hangers, stands, clamps, rollers, guides, shields, anchors and their proposed application. Submit detailed shop drawings, showing method of support and anchoring for all piping and equipment as follows:

1. Piping Systems:
2. Scaled single line piping plans superimposed on structural construction drawings. Scale shall be minimum 1/4" = 1'-0". Piping which is three inch (3") diameter and smaller may be omitted from these shop drawings. Drawings shall clearly indicate the location and type of each and every insert, hanger, stand, support, guide, isolator and anchor; and shall also indicate the size, type locations and method of attachment for all miscellaneous structural steel required.
3. Sectional drawings, sketches and other details as may be required to clearly communicate the method of support, anchoring, guiding and vibration isolation.
4. Show details of any typical floor or wall penetrations including: riser clamp, pipe sleeve, and provisions for water stop to prevent the water travel between penetrations.

1.5 INDUSTRY STANDARDS

A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. F&S Manufacturing Corp.
2. Fee and Mason Manufacturing Co.

PART 2 - PRODUCTS

2.1 HANGERS

A. Hangers In Contact With Copper Piping: Shall be copper plated or teflon coated. Hangers shall be Fed. Spec. WW-H-171E, Type 9. Acceptable: Grinnell Fig. 97 or 97C, or equivalent.

B. Hangers (other than in Contact with Copper Piping): Shall have manufacturer's standard finish. Hangers shall be of the following types:

1. Pipe 3" and Larger: Fed. Spec. WW-H-171E, Type 1. Acceptable: Grinnell Fig. 260 or equivalent.
2. Pipe 2-1/2" and Smaller: Fed. Spec. WW-172E, Type 6. Acceptable: Grinnell Fig. 104 or equivalent.

2.2 ISOLATORS

A. Refer to the Section, if included in this Division, which describes vibration isolation.

2.3 PIPE ROLLER STANDS

A. Shall be Fed. Spec. WW-H-171D, Type 47. Acceptable: Grinnell Fig. 171, or equivalent.

2.4 PIPE ROLLER HANGERS

A. Pipe Roller Hangers: Shall be Fed. Spec. WW-H-171E, Type 42. Acceptable: Grinnell Fig. 171, or equivalent.

2.5 PIPE ALIGNMENT GUIDES

A. Acceptable: Grinnell Fig. 256, or equivalent.

2.6 PIPE RISER CLAMPS

A. Pipe Riser Clamps: Shall be Fed. Spec. WW-H-171D, Type 8.

2.7 INSULATION SHIELDS

A. Shall be Fed. Spec. WW-H-171D, Type 41. Acceptable: Grinnell Fig. 167, or equivalent.

2.8 BEAM CLAMPS

A. Fed. Spec. WW-H-171D, Type 29. Acceptable: Grinnell Fig. 292 with links, or equivalent.

2.9 INSERTS

A. Preset Type: Malleable iron with removable interchangeable nuts having lateral adjustment of not less than one and five-eighths inches. Continuous inserts shall have a capacity of 2,000 lb. per foot and shall be hooked over reinforcing. Acceptable: C-B Universal Fig. 282; Unistrut Products Co., P3200 or P3300; B-Line Systems, Inc., Series B-32.1, or equivalent.

2.10 ROD

A. Carbon steel, black threaded bolt ends or continuous thread, sized with safety factor of five (5). Acceptable: Grinnell Fig. 140 or 146, or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Section entitled "General Mechanical Provisions". All inserts, fasteners, hangers and supports shall be installed in strict accordance with manufacturer's instructions.

3.2 PIPE

A. General: Hangers shall be spaced to prevent sag and to permit proper drainage. All piping shall be run parallel with the lines of building, unless otherwise indicated on drawings. The hanger spacing and placement shall be such that after the covering (insulation and finish) is applied, there will be not less than 1/2" clear space between finished covering and other surfaces, including the finished covering of parallel adjacent pipes. Hangers for insulated pipes shall be sized to encompass the insulation, finish and metal insulation shield (a metal insulation shield shall be provided for each hanger or support). Vertical piping shall be supported with pipe riser clamps at every floor penetration, unless specifically indicated otherwise on the drawings. Hangers and supports shall not be placed at greater than the following intervals:

1. Pipe 1" and Smaller: Eight foot (8') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).
2. Pipe 1-1/4" through 2-1/2": Ten foot (10') centers and not more than two feet (2') from a change in direction (offsets, elbows and tees).
3. Pipe 3" and Larger: Fourteen foot (14') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).

3.3 EQUIPMENT

A. Equipment supports shall be as otherwise indicated on the drawings or in the specifications.

3.4 DUCTWORK

A. Refer to Sections describing ductwork.

3.5 POWDER (GUNPOWDER) ACTUATED FASTENERS

A. Not allowed.

3.6 STEEL DECKING

A. On projects where floor or roof slabs are installed over steel decking, drill or punch web of steel decking and insert hangers with washers before the concrete fill is poured in place. Hangers shall be plumb within one-half inch (1/2") in four feet (4') and spaced as required for service intended.

END OF SECTION

SECTION 15191

IDENTIFICATION OF PIPING SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete identification of the mechanical systems including piping, valves and equipment as noted herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping and the interconnected equipment and component items for the following systems:

a. Chilled water.
b. Insulation.

1.4 APPLICABLE PIPING AND RELATED ITEMS

A. Piping and interconnected equipment and component items for the following systems shall be identified. Identification of the following systems shall not preclude the identification of other systems where identification of such other systems may be specified in other sections. Systems requiring identification as work of this section are:

1. Chilled water.

1.5 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Provide schedule of colors, lettering, tagging, handling and similar items to clearly identify proposed method of identification for mechanical systems.

1.6 DIMENSIONS

A. Pipe dimensions as used in this section refer to the total outside dimensions (diameters) of both the pipe and its insulation (if any).

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with ANSI A13. 1-1975, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.

B. Acceptable Manufacturers: W. H. Brady Co., 2223 West Camden Road, Milwaukee, WI 53201; Seton Name Plate Corporation, 592 Boulevard, New Haven, CT 06505, or equivalent.

2.2 MARKERS, BANDS, TAGS AND LABELS

A. Markers: Must have approved color coded background, proper color of legend in relation to background color, approved legend letter size, approved length and flow arrow indicator.

1. Pipes 3/4" through 5" O.D.: Seton "Setmark" Type SNA marker or equivalent.
2. Pipes 6" O.D. and Greater: Seton "Setmark" Type STR marker or equivalent.

B. Bands: Color coded in minimum widths of 2-1/4" for pipe through 12" O.D. and 4" for pipe 14" O.D. and greater. Brady B-500 Vinyl Cloth, B-350 PermaCode or B-946 Outdoor Film or equivalent as applicable.

C. Valve Tags: Each tag shall designate appropriate service and valve number. Be securely attached with meter seals with 4-ply 0.018 copper smooth wire, or brass "S" hooks, or brass jack chain in a manner to allow easy reading. Provide either of the following types:

1. Brass Type: Minimum 19 gauge polished brass; 1-1/2" min. diameter. Acceptable: Seton Style 250-BL or equivalent.
2. Aluminum Color Coded Type: Anodized aluminum; 2": min. diameter. Acceptable: Seton Style 2070 or equivalent.
3. Aluminum Alloy Type: 16 gauge sheet aluminum: depressed type letters filled with black enamel. Face and periphery of satin finish Alumilite, Alcoa 204A2 or equal, free from burns and scratches. Seton Type 4 or equivalent.
4. Fiber Glass Type: 1/16" thick glass fiber reinforced resin. 2" x 2" size of 2-1/2" x 9" size as necessary to identify item. Brady Series No. 2297 or equivalent.

D. Labels: Provide either of the following types:

1. Plastic Type: Outdoor grade acrylic plastic to withstand weather, abrasion, grease, acid, chemical and other corrosive conditions; 1/16" min. thickness. Sized 3/4 x 2-1/2, 1 x 2-1/2, 1 x 3 or 1-1/2 x 4 as necessary to identify item. Seton "Setonite" or equivalent.
2. Aluminum Type: Engraved, flexible, 0.020" thick aluminum. Sized 3/4 x 2-1/2, 1 x 3, 1-1/2 x 4 or 3/6 as necessary to identify item. Seton No. 06505 or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply only after completion of insulation, painting and cleaning work so that final identification is not disfigured by such other work.

B. Coordinate with actual composition and operating temperatures of surface on which identification is to be placed so that proper permanent adhesion of markers and labels to surface is obtained.

C. Locate marking and banding where practical such that groups of pipe are identified at similar location for ease of visual tracking. For example, mark and band parallel runs of pipe which are side-by-side at the same general place.

D. Small pipes less than 3/4" diameter may be identified with tags similar to those specified for valves.

E. Adhere or affix all identification items permanently except where removal may be necessary for maintenance or service.

3.2 MARKERS AND BANDS

A. Provide on piping as follows:

1. Pipe Concealed in Inaccessible Locations (e.g., Chases, Underground): No identification required.
2. Pipe Concealed in Accessible Locations (e.g., Ceiling Plenums):

a. Markers every 30 feet of pipe length. Bands every 15 feet of pipe length.

3. Pipe Exposed in Equipment Rooms:

a. Markers every 15 feet of pipe length for pipe through 12 inches O.D. and every 30 feet for pipe 14 inches O.D. and greater.

4. Bands every 10' of pipe length for pipe through 12" O.D. and every 25' for pipe 14" O.D. and greater.
5. Exterior Pipe, Exposed: No identification required unless otherwise indicated.

3.3 VALVE TAGS

A. Valve tags shall be installed on the following items:

1. All motorized valves (except those valves associated with direct control of flow to air handling apparatus whereby the valve may be identified by reference to the item of equipment it serves).
2. All fire protection system valves located in mains and branches (except those valves in fire hose cabinets).
3. All manual valves which perform functions other than isolation of an equipment item for servicing. This includes, but is not limited to, valves in valve stations, remote locations where use is not evident due to proximity of equipment or other piping, and similar locations.
4. Small piping (other than domestic water) where markers are impractical.
5. Small but critical equipment items on which it is impractical to install labels.

3.4 VALVE TAG LISTS

A. Prior to substantial completion, provide a complete list of all valves having tags. Indicate the following on such list:

1. Valve size.
2. Valve location.
3. Valve type.
4. Service application.
5. Valve manufacturer and model number.
6. Pressure class and allowable working pressure.

3.5 LABELS

A. Provide labels of proper size on mechanical system equipment including but not limited to, pumps, chillers, tanks, major piping components such as air separators, air handling equipment, fans, control panels, terminal units, flow stations, reheat coils and similar items.

3.6 COLORS

A. Colors for piping systems and equipment which are required to be painted shall be as follows for those systems which may be applicable to this project:

1. Domestic Cold Water: Medium green enamel with domestic cold water legend.
2. Domestic Hot Water and Domestic Hot Water Recirculation: White insulation with yellow tape or metal bands with domestic hot water (domestic hot water recirculation) legend.
3. Chilled Water Piping: Blue mastic with blue tape or bands with chilled water supply (or return) legend.
4. Heating Hot Water Piping: Burnt orange with heating hot water supply (or return) legend.
5. Gas Piping: Yellow with gas legend.
6. Compressed Air Piping: Light grey with compressed air legend.
7. Fire Protection Piping: Red with fire line legend.
8. Sprinkler Piping: Red with sprinkler legend.
9. Condenser Water Piping: Tan with condenser water supply (or return) legend.
10. Roof Drainage Piping: Light green with storm water legend.
11. Compressed Air Piping: Black with compressed air legend.
12. Natural or L.P. Gas Piping: Yellow with gas legend.
13. High (or Medium or Low) Pressure Steam Supply Piping: White insulation jacket or aluminum jacket with yellow tape or bands with HP (MP, L.P.) steam legend.
14. High (or Medium or Low) Pressure Steam Condensate Piping: White insulation or aluminum jacket with yellow tape or bands with HP (MP, LP) steam legend.
15. Equipment Hot Vent Piping (Below 100^{o}F): Light brown with vent legend.
16. Equipment Hot Vent Piping (Above 100^{o}F): Light brown tape or bands over insulation or metal jacket with vent legend.
17. Vacuum (Housekeeping): Light olive green with vacuum legend.
18. Fuel Oil (Supply, Return, Vent) Piping: Yellow with fuel oil legend.
19. Generator Exhaust Piping:

    a. Insulated: White insulation with yellow tape or band with generator exhaust legend.
    b. Bare Pipe and Fittings: Silver (suitable for extra high temperature application).

20. Sanitary Sewer and Vent Piping: Brown with sanitary sewer (vent) legend.
21. Electrical conduit (not specified as painted in other divisions of these specifications): Silver.

B. Identification: Coordinate colors and finishes with pipe identification.

END OF SECTION

SECTION 15201

VIBRATION ISOLATION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide vibration isolation supports for all equipment and piping as may be required to prevent transmission of vibration to building structure. This shall include air handling units, fans, piping, pumps and similar items.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the drawings and specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Submittal data shall show type, point loading information, size and deflection of each isolator proposed and any other information as may be required for the Architect/Engineer to check isolator selections for compliance with specifications. Include clearly outlined procedures for installing and adjusting the isolators.

1.5 MANUFACTURERS

A. Products of the following manufacturers will be acceptable, provided they comply with all of the requirements of this specification: Consolidated Kinetics; Mason Industries; Amber-Booth; Keflex; Flexonics; Vibration Eliminator Company or equivalent. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of item(s) required.

1.6 OTHER REQUIREMENTS

A. All vibration isolation equipment shall be both recommended by the manufacturer and approved by the Architect/Engineer for each particular application on this project.

PART 2 - PRODUCTS

2.1 BASIC REQUIREMENTS

A. Unless otherwise noted, spring type vibration isolators shall be used for all motor driven equipment. It shall be the responsibility of isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria referenced herein.

2.2 CORROSION PROTECTION

A. Steel components shall be phosphated and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welded slag and primed with zinc-chromate or metal etching primer.

B. All isolators exposed to weather shall have steel parts PVC coated or hot-dip galvanized. Aluminum components shall be etched and painted. Nuts, bolts and washers may be zinc-electroplated.

2.3 BASIC ISOLATORS

A. General: Unit designations indicated are Architect/Engineer designations. Each of the following basic isolators may not be applicable to a specific installation application. See PART 3, "EXECUTION".

B. Spring Mounts, Open Type, Unrestrained (Unit SMOU): Free standing springs; laterally stable; minimum horizontal-to-vertical spring rate (Kx/Ky) of 1.0: 1/2-inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); submittals shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type SLF; Korfund Series L; Amber-Booth Type SW.

C. Spring Mounts, Open Type, Restrained (Unit SMOR): Free standing springs; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); restraint consisting of welded steel channel ends for outdoor installation and welded steel studs for indoor installation; restraint shall have restraining bolts connecting top plate and lower housing to limit vertical rise of isolated equipment when load is reduced; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and housing (leveling bolts shall be adjusted to maintain this clearance). Submittal shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type SLR; Amber-Booth Type CT.

D. Spring Mounts, Housed, Unrestrained (Unit SMHU): Springs free standing within their housing; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); welded steel housing; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and housing (leveling bolts shall be adjusted to maintain this clearance). Submittal shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type C.

E. Neoprene and Spring Hangers, Vertical Deflection (Unit NSHV): Steel housing for undampened support of the spring: Provisions for attachment of hanger rods; reinforced neoprene washer and grommet to break up metal to metal contact; free standing spring; 1 inch minimum static deflection (unless otherwise specified) spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection. Submittals

shall include spring diameters, solid spring heights, free spring heights, deflections, overall hanger dimensions and maximum hanger rod diameter which can be accommodated by the hanger. Be similar to Mason Type DNHS: Amber-Booth Type BSR.

F. Neoprene and Spring Hangers, Vertical and Angular Deflection (Unit NSHVA): Shall contain a laterally stable steel spring and 0.3" reflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Mason Type 30N.

G. Neoprene and Spring Hangers, Vertical Deflection, Position Type (Unit NSHVP): Steel housing for undampened support of the spring; provisions for attachment of hanger rods; reinforced neoprene washer and grommet to break up metal to metal contact; free standing spring; 1 inch minimum static deflection (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; be capable of holding the supported item at fixed elevation during installation with secondary adjustment to transfer the load to the spring while maintaining a fixed position; scale and pointer to indicate the deflection. Submittals shall include spring diameters, solid spring heights, free spring heights, deflections, overall hanger dimensions and maximum hanger rod diameter which can be accommodated by the hanger. Be similar to Mason Type PCDNHS: Amber-Booth Type PBS.

H. Neoprene-In-Shear Hangers (Unit NH): Steel housing for undampened support of the neoprene; provisions for attachment of hanger rods; neoprene-in-shear isolator; similar to Mason Type HD, Amber-Booth Type HRD.

I. Neoprene-In-Shear Mounts (Unit NM): Double deflection neoprene-in-shear mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene-covered. The top and bottom surfaces shall be neoprene ribbed and bolt holes shall be provided in the base. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang; steel rails shall be by same manufacturer as vibration isolators and equivalent to Mason Industries Type DNR. Mounts shall be Mason Industries Type ND, Consolidated Kinetics Type RD or Vibration Mounts and Controls Series RD.

J. Flexible Pipe Connectors: Same internal diameter as the pipe in which the connector is installed (not necessarily internal diameters of inlets or outlets of equipment).

1. Both recommended by the manufacturer and approved by the Architect/Engineer to be suitable for handling the conveyed fluid at all conditions (maximums and minimums of temperatures, pressures, velocities, etc.) encountered for each particular application.
2. Of proper design to absorb the combination of vibratory and/or expansion or contraction motions (lateral and/or axial and/or angular) encountered at each installation point (for example, do not use hose type where axial motion is encountered at the installation point unless so recommended by the manufacturer and approved by the Architect.
3. Stainless steel bellows type (Unit SSB): Heavy duty steel restraining rods and spacers; laminated steel bellows; steel flanges; permit axial, lateral and angular movement; rated to withstand 180^{o}F operating temperature and 150 psig working pressure for chilled water; 250^{o}F operating temperature and 150 psig working pressure for heating hot water; similar to Keflex Series 151 or 301.
4. Stainless steel hose type (Unit SSH): Rated to withstand 180^{o}F operating temperature and 150 psig working pressure; have flanges except 2-1/2 inch and smaller sizes may have screw type fittings installed with a union at one end or with screw-on flanges at

both ends; net flexible lengths shall be at least 6 pipe diameters for pipe up to 5 inch ID and not less than 36 inches for pipe 6 inch ID and greater; corrugated bellows with stainless steel wire braid restraining sheath; similar to Flexonics Type RW, RF or Series 400, Mason Type BSS, Keflex Series SSH.

K. Acoustic Seals (Unit AS): Consist of an S-shaped molded synthetic rubber seal attached with stainless steel clamps to the pipe wall sleeves and to carrier piping. Wall sleeves shall be two pipe sizes larger than the carrier pipe and/or its insulation. Amber-Booth Type 301.

L. Steel Equipment Frames (Unit SEF): Frames shall consist of structural steel sections sized, spaced and connected to form a rigid base which will not twist, rack, deform or deflect in any manner that will negatively affect the operation of the supported equipment or the performance of the vibration isolation mounts. Frames shall be of adequate size and plan form to support basic equipment units and motors plus any associated pipe elbow or duct elbow supports and electrical control elements or other components closely related and requiring resilient support in order to prevent vibration transfer from equipment to the building structure. Frames shall include side mounting brackets for attachment to Unit SMOU isolator or other specified isolator. The clearance between the underside of any frame or mounted equipment unit and the top of the building structure below shall be at least 2 inches.

M. Neoprene Pads (Unit NP): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 Durometer neoprene. Mason Type W.

PART 3 - EXECUTION

3.1 GENERAL

A. All isolators shall be installed in strict accordance with the manufacturer's instructions and shall be properly adjusted prior to requesting final inspection or the performance of any vibration testing specified.

B. Each item of equipment (machinery, piping, etc.) which is provided with vibration isolation equipment shall rest in its intended, proper operating position (i.e; exactly level, etc.) after installation of vibration isolation equipment. Approval of such vibration isolation equipment by Architect/Engineer shall not relieve the Contractor of this responsibility.

C. Equipment which is specified to rest on concrete housekeeping pads shall have Unit NP pads unless otherwise indicated.

3.2 PIPING IN AIR HANDLING UNIT EQUIPMENT ROOMS

A. General:

1. Isolators for equipment are described elsewhere in this specification; and it shall be the responsibility of the vibration isolation manufacturer to coordinate the selection of piping supports with equipment supports to provide for a carefully engineered system designed to accommodate expansion and contraction without creating excessive stress at any equipment connections or in any portion of the piping.
2. Hangers for horizontal piping shall be installed at regular intervals. Pipe risers shall be supported at the base of the riser. Submit hanger schedule.
3. The first three piping supports away from any given piece of vibrating equipment to which piping is connected shall be selected for an operating spring deflection not less than that specified for the equipment isolators. All other vibration isolation supports for horizontal piping shall have a minimum operating deflection of 3/4" with capability

of 50% additional travel-to-solid. All supports for pipe risers shall have deflection capability at least four times the expansion or contraction to be accommodated.

4. Temporary anchors, where required, shall be installed to permit pre-adjustment of springs in risers. Pre-adjustment procedure, which is intended to control direction of pipe movement and final operating deflection of the springs, shall be detailed in submittal data.
5. Permanent limit stops shall be installed to prevent excessive vertical motion of risers in the event water is drained from system. Locations and other details of these limit stops shall be submitted to Architect/Engineer for acceptance.
6. Piping connected to vibration isolated equipment shall be installed so that it does not strain or force out of alignment vibration isolators supporting the basic equipment, nor shall pipes restrict such equipment from "floating" freely on its respective vibration isolation system.
7. Drain piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.
8. Do not allow the weight of the pipe to be carried by walls through which the pipe passes.

B. Isolator Locations:

1. Ceiling hung piping to air handling units: Provide neoprene and spring hangers, vertical and angular deflection (Unit NSHVA) at the first three support points of pipe runs connected to the vibrating equipment or at all support points along the first 50 feet of pipe runs connected to the vibrating equipment, whichever length is greater, but not to exceed length of mechanical equipment room.
2. Floor supported piping to air handling units: Provide resilient support for floor supported piping same locations as specified above for ceiling hung piping. Provide open type unrestrained spring mounts (Unit SMOU) for first three support points; use neoprene-in-shear mounts (Unit NM) thereafter and both with supplemental supports as required by job conditions.
3. Acoustic Seals: Provide acoustic seals (Unit AS) at all wall, ceiling and floor openings through which pipe runs from equipment rooms into adjoining spaces.

3.3 AIR HANDLING UNITS, FACTORY PACKAGED

A. Floor Mounted:

1. Spring mounted (Unit SMOU) with 1 inch minimum static deflection when AHU motor is 5 hp. or less; spring mounts with 2 inch minimum static deflection when AHU motor is 7-1/2 hp. or greater. Instead of bolting the units to the spring mounts, provide height saving brackets.
2. Flexible duct connections as specified in "Duct System Accessories" section.
3. Flexible pipe connectors (Unit SSB).
4. Steel equipment frame (Unit SEF) manufacturer's standard unit frame or base is not sufficiently stiff and rigid to permit point vibration isolation.
5. Mount equipment on reinforced concrete pads as specified in other sections.

B. Suspended from Building Structure:

1. Spring hangers (Unit NSHV) with 1-inch minimum static deflection when motor is 5-HP or less; spring hangers (Unit NSHV) with 2-inch minimum static deflection when motor is 7-1/2 HP or greater.
2. Flexible duct connectors as specified in Section entitled "Ductwork".

3.4 FAN COIL UNITS AND FANS, IN-LINE CENTRIFUGAL LIGHT DUTY AND HEAVY DUTY

A. Flexible duct connectors as specified in "Ductwork".

B. Neoprene-in-shear hangers (Unit NH).

C. Piping (first 10 feet) with neoprene hangers (Unit NH).

3.5 MANUFACTURER'S SUPERVISION

A. The Contractor shall include in his price the cost of the vibration isolation manufacturer or his qualified representative for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after system is put into operation, the manufacturer or his representative shall make a final inspection and submit his report to the Architect/Engineer in writing certifying the correctness of installation and compliance with approved submittal data.

END OF SECTION

SECTION 15251

INSULATION, HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all work necessary to insulate all equipment, piping, ducts and other items related to the piping and duct systems.

1.3 RELATION TO OTHER WORK

A. Refer to the section, General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Piping systems.
2. Duct systems.
3. Heat generating equipment.
4. Heat exchange equipment.
5. Cooling equipment.

C. Vessels, tanks, stacks, and other items which contain or convey fluids which are at such temperatures as to create condensation or surface temperatures which are hazardous or where heat loss or gain prohibits proper system operation.

1.4 SHOP DRAWINGS

A. General: Refer to the Section entitled "General Mechanical Provisions". Shop drawings shall contain complete descriptive and engineering data, including flame spread and smoke developed ratings (ASTM E84 test method) on all materials and adhesives. Where finishes, covers, or jackets are specified, provide complete data on same. Shop drawings shall contain specified information on: densities, conductivities, conductances, or resistances as required to establish conformance with the specified values or materials.

B. Industry Standards: Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

C. Commencement of Work: Submit shop drawings before any work is commenced.

1.5 STORAGE OF MATERIALS

A. Do not store fiberglass insulation within the building until it has been "dried in". If no other dry space is available and this insulation must be installed or stored before the building is "dried in" and completely enclosed, provide polyethylene film cover for protection.

1.6 COMPLIANCE WITH CODES AND STANDARDS

A. Applicable Codes: The total insulation system including insulation, sealant, finishes, etc., shall comply with or exceed all code requirements.

B. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A as to flame spread and smoke developed ratings.

1.7 DEFINITIONS AND TERMINOLOGY

A. Terminology: Throughout this section, insulation products may be described as regards the location, surface or other point at which they are to be applied. Except in special cases (where a detailed indication or description will be given), the majority of conditions can be defined in whole or in part by use of (but not necessarily limited to) any or all of the following words:

1. "Internal" or "External".
2. "Interior" or "Exterior".
3. "Concealed" or "Exposed".
4. "Protected" or "Unprotected".

B. Definitions: Wordage used to describe locations, surfaces or other points or conditions shall be defined as follows as related to this section. Where the ascertainment or determination of locations, surfaces and other conditions is obvious from the intent of use of the item (e.g., roof-mounted ductwork, underground piping, etc.) or from other information, then the following words may not be required. If any ambiguity should occur, provide bid based on the most severe condition; however, obtain clarification from Architect/Engineer prior to installation:

1. "Internal" and "External": Relates to an item or its surface which is to be insulated or uninsulated. Does not relate to the confines of the building, structure or other entity in which the item is located. (Examples: internal/external surfaces of ductwork, pipe, air handling units or other such items.)
2. "Interior": Relates to the location of an item as to whether the item is within a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure or other entity in which the item is located. "Interior" is always "Protected". (Examples(s): Interior ductwork, interior piping, interior air handling units.)
3. "Exterior": Relates to the location of an item as to whether the item is outside (i.e., exterior to) a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure, facility or other entity which the item serves or relates. "Exterior" generally means that the item is surrounded by the ambient outside environment. "Exterior" is considered "Unprotected" unless otherwise described. (Examples(s): exterior rooftop air handling units, exterior ductwork, exterior cooling tower.)
4. "Concealed" and "Exposed": Relates to the visibility of an item. "Concealed" implies out-of-sight from normal view by an occupant, user or employee of the facility when such person is performing their normal function. "Exposed" implies that the item is readily visible by such a person when that person is performing a normal function. (Examples(s): "Concealed interior ductwork" would be out-of-sight in a ceiling plenum, whereas "exposed interior ductwork" would be readily visible in a mechanical equipment room or in a room which intentionally had no ceiling system.)
5. "Protected" and "Unprotected": Relates to an exterior item which may or may not be sheltered from the outside elements but which exists in contiguous contact with the ambient environment without benefit of any direct heating, ventilating or air conditioning. (Example(s): Piping or ducts located in an open crawl space beneath a building would be "protected/concealed"; in an open parking garage such piping or ducts would be "protected/exposed". Piping or ducts on a rooftop would be "unprotected" and usually "exposed".)

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials: Materials listed are those used as basis of design; equivalent products of acceptable manufacturers will be accepted. Materials must be approved and recommended by the insulation product manufacturer for the particular application(s).

B. Flame and Smoke Ratings: Application of insulation materials may require, in many cases, that the final insulation system comply with NFPA 90A with regard to maintaining a flame spread rating of 25 or less and a smoke developed/fuel contributed valve of 50 or less. In such cases, verify that the materials comply with the indicated flame spread and smoke developed ratings.

C. Applicability: Products and manufacturers listed may not all be applicable. Use only those products and manufacturers which are indicated as being applicable to a specific insulation condition.

D. Acceptable Manufacturers: Manufacturers which are listed are those manufacturers who may make one or more of the insulation products required. Listing of a manufacturer does not necessarily mean the manufacturer is approved for all applicable insulation conditions. Each listed manufacturer must still comply with the specific requirements of each insulation condition to be acceptable for the particular application. Acceptable manufacturers of insulation-related products include (but are not necessarily limited to) the following: Armstrong; CertainTeed; Childers Products Co.; Knauf; Manville; Owens-Corning; Pittsburg Corning; Rubatex; Upjohn Co.; Duracote Corporation; Ferro Corporation; Dow Corning Corporation; Duro Dyne Corporation; Goodloe E. Moore, Inc.; 3M Co.; United McGill Corporation, Vimasco Corporation; Foster; Gustin-Bacon; Nomaco Inc.; Insulcoustic; Molded Acoustical Products; Lion Nokorode and other manufacturers as may be listed for a specific application.

2.2 BASIC MATERIALS

A. Cellular Glass Insulation: Preformed or block type as indicated or as applicable. Fire, water and vermin retardant; closed cell glass composition; density of 8.5-pcf. Comply with the following: ASTM C 552, "Specification for Cellular Glass Thermal Insulation"; Military Specification MIL-I-24244B. Flame spread rating of "5" and a smoke developed rating of "0" as per ASTM E 84. Recommended temperature applications from -450^{o}F to 1200^{o}F when installed in accord with manufacturer's recommendations. Pittsburg-Corning Foamglas.

B. Elastomeric Insulation: Preformed (tube), roll or sheet as indicated or as applicable. Nitrile, rubber based, closed cell structure. K factor of 0.28 at 75^{o}F. In tube, roll or sheet form of 3/4-inch thickness or less, ASTM E 84 flame spread rating of "25" or less and smoke developed rating of "50" or less. Recommended temperature applications from -40^{o}F to 220^{o}F when installed in accord with manufacturer's recommendations. Do not install in return air plenums unless flame spread rating and smoke developed rating are within constraints of applicable codes. Manufacturers and/or series: Armstrong "Armaflex"; Manville "Aerotube"; "Rubatex"; Gustin-Bacon "Ultra-Foam".

C. Fiberglass Insulation: Inorganic fibrous glass. Flame spread of "25" or less and smoke developed rating of "50" or less per ASTM E 84.

1. Board: Rigid or semi-rigid form, faced or unfaced as indicated. Stiffness of 475 EI, 800 EI or 1400 EI as indicated.
2. Blanket: Flexible form; faced, unfaced or coated as indicated.
3. Preformed: Jacketed or unjacketed as indicated.

2.3 INSULATION PRODUCTS, BASIC

A. Type PI-1: Pipe insulation, preformed cellular glass. Pittsburg-Corning "Foamglas" or equivalent.

B. Type PI-2: Pipe insulation, preformed jacketed fiberglass. Jacketed with factory-applied kraft reinforced foil vapor barrier jacket. Jacket closure system of double pressure-sensitive adhesive on longitudinal joints; self-sealing butt strips at circumferential joints; provide positive vapor barrier seal. Thermal conductivity (K) of 0.24 at 100^{o}F. Owens-Corning Fiberglas ASJ/SSL-II; Manville Micro-Lok with AP-T Plus jacket; CertainTeed 500 Snap-On; or equivalent.

C. Type PI-3: Pipe insulation, preformed unjacketed fiberglass. Suitable for field-jacketing. Thermal conductivity (K) of 0.23 at 100^{o}F. Owens-Corning Fiberglas No-Wrap, Manville Micro-Lok, or equivalent.

D. Type PI-4: Pipe insulation, preformed segmental rigid calcium silicate. Thickness as indicated; provide single layer where nominal pipe size allows; provide "factory nested" double layer when nominal pipe size so requires for the thickness indicated. Owens-Corning Kaylo; Manville Thermo-12; or equivalent.

E. Type PI-5: Pipe insulation, preformed elastomeric. Rubatex, Armaflex II or equivalent.

F. Type I-1: Cellular glass block insulation. Field formed, fitted and finished as required for the application. Pittsburg-Corning Foamglas or equivalent.

G. Type I-3: Elastomeric insulation. Field formed, fitted and finished as required for the application. Armaflex, Rubatex or equivalent.

H. Type I-4: Fiberglass flexible blanket insulation. Unfinished, non-combustible, wool-like; composed of long glass fibers bonded with a thermosetting resin. Thermal conductivity (K) of 0.23 at 100^{o}F. Applicable where indicated for boilers, vessels, breaching and stacks operating at up to 1000^{o}F. Finished or held in place by wire ties, metal lath, lagging or as indicated. Owens-Corning Thermal Insulating Wool TIW Type II or equivalent.

I. Type DI-1: Duct insulation, fiberglass flexible blanket wrap. Composed of flexible blanket of glass fiber factory laminated to a reinforced foil kraft (FRK) vapor barrier with a minimum 2-inch taping and stapling flange on one edge. Suitable for operation at temperatures from 40^{o}F to 250^{o}F. Thermal conductivity of 0.31 at 75^{o}F. Minimum density of three-quarter (3/4) pound per cubic foot. Provide in thickness of (2.2) inches unless otherwise specified as 2-1/2 or 3-inch thickness. Owens-Corning All Service Faced Duct Wrap; Manville R-Series Microlite; CertainTeed Standard Duct Wrap; or equivalent.

J. Type DI-2: Duct insulation, fiberglass semi-rigid board. Composed of resin bonded glass fibers faced with a foil scrim-kraft (FSK) reinforced laminate of aluminum foil and kraft bonded to provide a metallic surface finish vapor barrier; alternate vapor barrier facing (if specifically indicated) is an all service jacket (ASJ) of high intensity white bleached, chemically treated kraft paper reinforced with fiberglass yarn mesh and laminated to aluminum foil with fire-retardant adhesive to impart a clean, white appearance. Conductivity (K) of not greater than 0.23 at 75^{o}F. Provide in thickness of one (1) inch unless otherwise indicated. Provide with minimum density of 3-pcf unless 6-pcf is specifically indicated. CertainTeed Industrial Insulation Board Type IB-300 (or IB-600); Manville 800 Series Spin-Glas Type 814 (or 817); Owens-Corning 700 Series Industrial Insulation Board Type 703 (or Type 705); or equivalent.

2.4 INSULATION ADHESIVES, MASTICS, SEALANTS

A. Adhesive (Type A-E1): For joints and seams in elastomeric insulation (Type I-3) not requiring weather protection. Rubatex R-373 Insulation Adhesive; Armstrong 520 Adhesive or equivalent.

B. Joint Sealant (Type JS-CG1): Non-hardening vapor barrier sealant specifically designed for use with cellular glass insulation (Types PI-1, I-1): Foster's 35-40 Foamseal Sealant, Pittsburg-Corning Pittseal 111 Sealant or equivalent.

C. Adhesive (Type A-F1): For adhering fiberglass blanket and board insulations (Types DI-1, DI-2) to metal substrate such as ductwork. Insulcoustic I-C 201, Foster 85-20 or equivalent.

D. Mastic, General Purpose (Type M-GP1): Non hardening vapor barrier general purpose mastic. For use where indicated or otherwise applicable. Foster GPM 35-00 or equivalent.

2.5 INSULATION FINISHES, JACKETS AND COVERS

A. Finishing Coating (Type FC-E1): For weather protection of elastomeric insulations (Types I-3, PI-5). Rubatex 374 coating; Armstrong Armaflex Finish or equivalent.

B. Finish Mastic (Type FM-CG1): For cellular glass insulations (Types PI-1, I-1). Waterproof, weather, acid and alkali resistant asphalt mastic coating for use in the range of -40^{o}F to 200^{o}F (installation must be done when in the 50^{o}F to 120^{o}F range). Pittsburg-Corning Pittcote 300 Vapor and Weather Barrier Finish or equivalent.

C. Finish Fabric (Type FF-CG1): For cellular glass insulations (Types PI-1, I-1). 6 x 6 meshes per inch polyester fabric for reinforcing the finish mastic. Pittsburg-Corning PC Fabric 79 or equivalent.

D. Finish Fabric, General Purpose (Type FF-GP1): Nylon membrane. For use generally with fiberglass duct insulations (Types DI-1, DI-2) at joints or seams or as may be indicated. Apply using Foster GPM 35-00 or equivalent.

E. Jacket, Underground Pipe (Type JP-CG-1): For cellular glass pipe insulations (Type PI-1, I-1) where indicated. Prefabricated laminate containing a 20 x 10 mesh asphalt impregnated glass fabric and a 1-mil thick aluminum foil sandwiched between three layers of a bituminous mastic. External jacket surface coated with a protective plastic film and internal surface with a special release paper. Apply around cellular glass pipe insulation in a cigarette type wrap with the overlap heat sealed. Seal butt joints in the same manner using a 4-inch wide seal strip of the jacketing. Irregular surfaces of the pipe system shall have the jacket's plastic film burned away prior to application of a 20 x 10 asphalt impregnated mesh which shall be sandwiched between two glove coats of finish mastic (Type FM-CG1).

F. Jacket, Pipe, PVC (Type JP-PVC): All purpose, UL-rated, white vinyl jacket, with or without self-sealing feature. Pittsburg-Corning "UNI-JAC" or equivalent.

G. Jacket, Pipe, Aluminum (Type JP-A1): Aluminum jacketing, 0.016 inches thick, type 3003 alloy, H-14 temper, circumferentially corrugated, with a continuously laminated moisture barrier of one mil polyethylene film and a protective layer of 40 lb. virgin kraft paper. Childers Products Co. "Corolon"; General Aluminum Supply Co. (Gasco); Insulcoustic "Alcorjac" or equivalent.

H. Pipe Fitting Covers, PVC (Type PFC-PVC): Insulated polyvinyl-chloride fitting covers in shapes as required; with fiberglass insulation insert. Suitable for temperature range of 0^{o}F to 450^{o}F. Flame spread rating of 25 or less and smoke developed rating of 50 or less

when kept below 150°F. Acid, alkali and chemical resistant. Suitable for painting if required. Manville Zeston 25/50 PVC Insulated Fitting Covers or equivalent.

I. Pipe Fitting Covers, Aluminum (Type PFC-A1): Aluminum fitting covers, 0.020 inches minimum thickness, type 3003 alloy, H-14 temper prefabricated fitting covers with baked epoxy moisture barrier for pipe sizes through 24". Field fabricate fitting covers for pipe sizes larger than 24" using 0.020 inches thick aluminum roll jacketing with laminated polyethylene/kraft moisture barrier. Childers Products "Ell-Jacs", "Gore Ell-Jacs", "Tee-Jack", "End-Caps", and "Flange Jacs" or equivalent.

2.6 RELATED PRODUCTS

A. Wire (Type W-1): Dead soft, 16-gauge, stainless steel.

B. Straps (Type ST-1): Stainless steel T-304 (18-8) soft annealed with deburred edge with stainless steel wing seals. Childers Products "Febstraps" or equivalent.

C. Tape (Type T-1): High tensile strength rope stock flat back paper pressure sensitive tape. Pittsburg-Corning "PC Tape No. 25" or equivalent.

D. Screws (Type S-1): Aluminum pan head type "A" slotted #8 by 1/2-inch.

PART 3 - EXECUTION

3.1 GENERAL

A. Field Forming, Fitting and Finishing: Where preformed insulation products are indicated as being acceptable for a particular application, provide field formed, fitted and finished insulation systems if such application is more practical (such as due to size, configuration or dimensions which may be outside of the availability ranges for size, dimension and/or thickness of preformed products).

B. Pre-installation:

1. Do not apply insulation adhesives, materials or finishes until the item to be insulated has been completely installed and tested and proved tight and suitable for insulation.
2. Prepare surfaces to be clean and dry before attempting to apply insulation.

C. Insulation Shields: Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end.

D. Valves, Cocks and Specialties: Insulate as for the related piping system in which they are located unless otherwise indicated.

E. Factory Pre-insulated Components: Where equipment and other system components are specified in other sections to have factory installed insulation, then no additional insulation is required as work of this section unless additional non-factory-installed insulation is specifically described. Examples of such equipment and components which may not require additional insulation include, but are not necessarily limited to, boiler vessels, chiller evaporators, air handling units, airside terminal units, and similar items.

F. Minimum Thicknesses: Insulation thicknesses which are indicated are minimum thicknesses. Contractor may provide the same insulation material in greater thickness as an aid to installation and handling procedures or due to material availability and procurement considerations.

G. Branch Runouts: Branch runouts are considered to be individual supply/return pipes to individual terminal heating or cooling units (duct mounted coils, airside terminal units with heating coils, fan coil units, humidifiers, and similar small equipment). The supply/return pipe to such units is not considered to be a branch runout if the length of the supply or return pipe exceeds 12'-0" in length to the coil/unit connection.

H. Insulation for Plumbing Systems: See other sections describing insulation for plumbing systems.

3.2 INSULATION THICKNESS FOR PIPING SYSTEMS

A. General:

1. Basis: Insulation thicknesses for piping are given for insulation installed in the locations indicated. Thicknesses are based on the various conditions of temperature, usage and environment which are typically encountered.
2. Applicable Thicknesses: All thicknesses as applicable to all conditions may not be given in this section article. Where an insulation thickness for a particular application is specified to be of other thickness than may be listed in this section article, "INSULATION THICKNESSES FOR PIPING SYSTEMS", then provide the insulation in the thickness indicated in other portion of this section which specifically describes the particular insulation application and its required insulation thickness. Thicknesses for other than piping insulation are given in the specific description of the particular application or description of the particular material used.
3. Ambient Conditions: Unless otherwise indicated, ambient conditions for the purpose of describing insulation thicknesses are related to cold applications to prevent condensation or excessive heat gain (e.g., chilled water pipe, cold vessels) and are related to hot applications to prevent harm to personnel or to prevent objectionable heat loss to the environment (e.g., hot water pipe, hot vessels, hot stacks).

    a. These conditions are generally:

    Interior: 80^{o}F and 80% RH.
    Exterior: 90^{o}F and 80% RH.

4. Thickness Requirements: Thicknesses are given below based on the following information:

    a. General type of fluid or process involved (e.g., chilled water, hot water, steam, refrigerant).
    b. General location and, if necessary, conditions related to temperature (either or both internal or external to the insulation barrier) and ambient environment of the insulated item.
    c. Pipe size range.

B. Chilled Water Piping Systems: Fluid generally considered to be between 40^{o}F and 65^{o}F. Thickness is for cellular glass unless other insulation material is indicated.

Location or Description	Pipe Size (inches)	Insulation Thickness
Interior	Up to 1	1-1/2"
Interior	1-1/4 to 4	2"
Interior	6 and up	2-1/2"
Exterior	Up to 4	2-1/2"
Exterior	6 and up	3"
Underground	All Sizes	2"

3.3 CHILLED WATER PIPING SYSTEMS

A. Interior, Concealed (e.g., ceiling plenums): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with a layer of fabric (FF-CG1) applied between two glove coats of mastic (FM-CG1). Mastic and fabric shall be applied in strict accordance with the manufacturer's recommendations.

B. Interior, Exposed (e.g., central mechanical rooms, air handling unit rooms): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with jacketing (JP-A1). Secure jacketing with straps. Finish elbows and fittings with mastic (FM-CG1), reinforced with fabric (FF-CG1); or finish with fitting covers (PFC-A1). Finish materials shall be applied in strict accordance with the manufacturer's recommendations.

C. Interior, Exposed, Special Locations: Same as for "Interior, Concealed" with the additional requirement that the final coat of mastic for the insulation finish shall be especially gloved and finished smooth to accept painting of color(s) required in other divisions as specially selected by the Architect/Engineer. These special locations consist of exposed piping in the following normally occupied areas of the building:

1. Gymnasium.
2. Natatorium.

D. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as required.

E. Exterior, Unprotected: Same insulation system as for "Exterior, Protected" except thickness as required.

F. Underground: Insulate with cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with underground jacket (JP-CG1) having 2-inch minimum overlap of the longitudinal seams. Heat seal longitudinal seams with a propane torch. Cover butt joints with a 4-inch wide strip of jacket with the edges heat sealed around the circumference. Precut the jacket to fit the contour or irregular surfaces such as 90^{o} bends, 45^{o} bends, fittings, etc. to which it is to be applied; in addition to heat sealing the jacket on these irregular surfaces, burn away the polyester film and glove a coat of mastic (FM-CG1) on the surface; while this coat is still tacky, embed a 10 x 10 asphalt impregnated fabric (FF-CG1) into the mastic. After this application has dried for not less than one hour, apply another coating of mastic. Caution: Keep mastic away from sparks and open flame and keep container closed when not in use.

G. Underground Expansion Joints, Expansion Elbows and Expansion Loops: Provide oversized insulation telescoped over the adjacent pipe insulation to provide close fit and adequate annular space to allow all movement expected to be encountered through maximum

temperature ranges (including idle) of the conveyed fluid. Provide 1-1/2 pcf density fiberglass pipe insulation of thickness equal to the cellular glass insulation beneath the oversized insulation to completely fill the annular space void and yet allow freedom of pipe movement. Comply with insulation manufacturer's recommendations for these conditions or with details on drawings, as applicable.

3.4 DUCT SYSTEMS

A. General:

1. Locations and extent of both internal and external insulation for duct systems are described in section entitled "Ductwork" and/or by the "Duct Type and Location Schedule" on the Drawings.
2. Internal Insulation: Ductwork which is required to be insulated internally (acoustically/thermally lined) shall be insulated as work of the section entitled "Ductwork".
3. External Insulation: Ductwork which is required to be insulated externally shall be insulated as work of this section.
4. Factory Insulation: Ductwork which is factory manufactured with internal or external insulation is not to be additionally insulated as work of this section unless specifically stated. Such factory insulated ductwork generally consists of flexible externally insulated ductwork and double walled acoustically thermally lined ductwork.

B. Interior, Concealed (e.g., ceiling plenums): Where external insulation is required, insulate externally with 2.2 inch thick fiberglass blanket wrap (Type DI-1). Adhere duct insulation using adhesive (Type A-F1) applied in accordance with the manufacturer's recommendations. Where duct width exceeds twenty-four inches (24"), the insulation shall be additionally secured to the bottom of the duct using mechanical fasteners spaced one foot (1') on center. Insulation shall be applied with edges tightly butted, and all joints and breaks in the vapor barrier sealed using glass fabric and mastic applied in conformance with manufacturer's recommendations.

C. Interior, Exposed, (e.g., air handling unit rooms): Where external insulation is required, insulate with 1-inch thick semi-rigid fiberglass board (Type DI-2). Adhere to ductwork with adhesive (Type A-F1). Finish joints and seams with finish fabric (Type FF-GP1).

3.5 DUCT SYSTEMS EQUIPMENT

A. General: Insulate as follows unless detailed to a greater extent on the Drawings.

B. Fire damper and Fire/Smoke Damper External Surfaces:

1. Externally Insulated Duct Locations: Extend duct insulation up face of fire damper to damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.
2. Internally Insulated Duct Locations: Provide additional external insulation from a point on the duct 12 inches from the fire damper to the fire damper and on the face of the fire damper to the fire damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.

C. Air Distribution Devices: Insulate the backs of all ceiling diffusers and other air outlet devices installed in other than return air plenums as specified for interior concealed ducts.

3.6 COLD EQUIPMENT AND RELATED COMPONENTS

A. Condensate Drain Piping From Cooling Equipment:

1. Interior, and Exterior, Protected: Insulate with preformed elastomeric pipe insulation (Type PI-5) secured with adhesive (Type A-E1) and finished with white finish coating (FCC-E1). Thickness 3/4-inch. Provide 25/50 flame/smoke rating.
2. Exterior, Unprotected: None applicable.

B. Cold Surfaces at Chillers and Evaporators: Factory insulated. No insulation required as work of this section.

C. Flexible Pipe Connectors for Vibration Isolation: Insulate with elastomeric insulation (Type 1-3). Secure the insulation with adhesive (Type A-E1) applied to a clean surface and finish with white finish coating (FC-E1). Insulation thickness shall be one and one-half inches (1-1/2").

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. Where it is desirable or necessary to support the pipe hangers to concrete, inserts shall be placed in the forms by the Mechanical Contractor prior to the time concrete is poured.

B. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of concrete slab.

C. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.

D. Pipes passing through walls, floors shall have sleeves of the same materials as the pipe. Sleeves shall allow insulated pipes to pass without changing the insulation thickness. Clearance around sleeves shall be packed with glass fiber after completion of pipe work. Sleeves in all floor slabs except slabs on grade shall have pipe sleeves extended 1 inch above finish floor to prevent water from running through sleeves to area below. Make watertight, caulk with sealant around each sleeve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall furnish all labor, materials, *including gases* equipment and instruments required to conduct tests of piping systems. Tests shall be as herein called for.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. Tests shall be conducted and the inspection of the piping shall be made in the presence of the Architect and/or Engineers.

D. Material and/or joints found defective shall be replaced and/or corrected and additional tests shall be conducted after correction of work.

3.2 PIPE SIZING, DRAWINGS AND SPECIFICATIONS

A. It is intended that work covered by these specifications and drawings include everything requisite and necessary to make the various systems complete and operative, irrespective of whether or not every item is specifically provided for. Any omission of direct reference herein to any essential item shall not excuse contractor from complying with the above intent.

B. Figured dimensions supercede scaled ones. Contractor shall take no advantage of, and shall promptly call the Owner's Representative's attention to any error, omission or inconsistency in specifications and drawings.

C. Special attention is directed to requirements that equipment and materials stated in specifications and/or indicated on drawings shall be furnished, except if otherwise noted, completely installed, adjusted and left in safe and satisfactory operating condition. Accessories, appliances and connections necessary for operation of equipment shall be provided to satisfaction of the Owner's Representative.

D. Materials, apparatus or equipment specified or otherwise provided for on drawings, addenda, or change orders issued subsequent to award of contract shall be same brand, type, quality and character originally specified unless otherwise provided.

E. Layout of equipment, accessories, specialties and suspended, concealed or exposed piping systems are diagrammatic unless dimensioned. In preparing shop drawings, contractor shall check project conditions before installing work. If there are any interferences or conflicts, they shall be called to attention of the Owner's Representative immediately for clarification.

F. The drawings indicate required size and points of termination of pipes and ducts and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of this contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further obstruction or cost to the Owner.

G. Shop drawings shall be furnished by this contractor, indicating all changes to meet space requirements, code requirements and as necessary to resolve all space conflicts.

H. It is intended that all apparatus be located symmetrical with architectural elements, and shall be installed at exact height and locations as shown on the architectural drawings. Refer to architectural details in completing and correlating work.

I. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract, prior to submitting his bid. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible.

J. The contractor shall carefully examine any existing conditions, existing piping and ducts and premises and compare the drawing with the existing conditions, prior to submitting his bid.

K. It cannot be too strongly emphasized that, except for work specifically excluded herein, every system shall be turned over to Owner installed completed, with components, ready for normal operation.

L. In addition to work shown on mechanical drawings, see Architectural Drawings for existing work to be removed, relocated and/or modified. Modify existing systems by rerouting for systems to remain or remove the abandoned systems as required to accommodate new general construction, plumbing, electrical and mechanical work.

M. Pipe sizes shall be minimum as allowed by local codes or as shown on the drawings, whichever is larger.

END OF SECTION

SECTION 15401

SANITARY SEWER, STORM WATER & SANITARY VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIAL

A. The following schedule covers materials unless otherwise specified under a particular System Section.

2.2 PIPE

A. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 2" Through 15" size, bell and spigot joint.

B. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 1-1/2" through 10" size, "non-hub" joint.

C. Reinforced concrete pipe (RCP) 12" through 144" bell and spigot pattern with O-ring rubber gaskets, ASTM C76.

D. Copper type DWV.

E. Brass pipe or tube, chrome plated.

F. PVC Type DWV, ASTM D2665-78. 1-1/2" through 6" size.

2.3 PIPING APPLICATIONS

A. For above ground soil waste and vent piping, use any of the following materials:

1. Cast iron soil pipe service weight “NO-HUB” joints.
2. Copper type DWV.
3. Brass pipe or tube, chrome plated. This shall be provided for all above ground p-traps. PVC p-traps are not acceptable.
4. PVC type DWV, ASTM D2665-78.

B. For below ground soil waste and vent piping, use any of the following materials:

1. Grease line: Cast iron soil pipe service weight bell and spigot. PVC shall not be acceptable.
2. Sanitary waste:

a. Cast iron soil pipe service weight bell and spigot.
b. PVC type DWV, ASTM D2665-78. (Note: In HVAC plenums, PVC piping shall not be installed.)

3. Storm (Refer to size limitation in Section 2.2):

a. Cast iron soil pipe service weight bell and spigot.
b. PVC type DWV, ASTM D2665-78.
c. Reinforced concrete pipe.

2.4 FITTINGS

A. Cast-Iron Soil Pipe:

1. Underground: Provide fittings of same weight and manufacture as pipe in which installed. Joints shall be bell and spigot push-on type neoprene gasket or "NO HUB" type conforming to CIPI Standard 301 unless noted otherwise on drawings.
2. Above ground and in buildings: "NO-HUB" type conforming to CIPI Standard 301 unless noted otherwise on the drawings.

B. Threaded Drainage Pipe: Cast-iron, recessed.

C. Copper DWV: Cast or wrought solder joint DWV drainage fittings.

D. PVC Type DWV: ASTM D-2665, NSF Seal of Approval, Solvent-cement joint.

2.5 PIPE JOINTS

A. Bell and spigot type joint shall be made with push-on compression type, neoprene gasket conforming to ASTM A-74.

B. No-hub type joints shall be constructed of 24 gage type 304 stainless steel, with gasket guides, type 304 stainless steel screw clamp, and matching neoprene (ASTM C-564) gasket that shall interlock with housing.

C. Joints in copper piping shall be made with tin-antimony solder (95-5) silver solder and non-acid flux.

D. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (Seal-tite).

2.6 VENT FLASHING

A. Furnish 4 lb. lead flashing, material as recommended by roofing system manufacturer, or copper pitch pans for all vents through the roof. Type of flashing used shall be compatible with piping material.

2.7 IDENTIFICATION

A. Below grade piping identification and warning tape shall be 0.004 inch thick polyethylene, printed with a continuous two line message. Tapes used for non magnetic piping materials shall have a metallic core. Acceptable manufacturer is Seton Name Plate Corporation or approved equal.

B. Above ground piping identification tape shall conform to ANSI and ASME A13.1 2007.

PART 3 - EXECUTION

3.1 GENERAL

A. The design drawings are generally diagrammatic. They do not show every bend, off-set, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. Joints and connections shall be made permanent and watertight.

D. Run piping to sewer connection point outside of building or as indicated on drawings.

E. Install 3" and larger horizontal soil and waste piping to 1/8" per foot slope. Piping 2" and smaller shall be installed at a slope of 1/4" per foot. Run horizontal vent lines to a minimum grade back to stacks and vertical vent lines as direct and free from bends as possible.

F. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.

G. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).

H. Minimum cover for exterior underground piping is three feet over conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive bells, collars, and couplings. Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 18" has been deposited over pipe or conduit.

I. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second

line with type of service below. Red tape is to be used for sewer, (Print type of water on tape; i.e., storm water.)

J. Where condensate piping is indicated, piping shall be extended to the nearest catch basin/yard drain. A cast iron back water valve shall be provided with epoxy-coated steel access housing.

3.2 HANGERS AND SUPPORTS

A. Vertical Piping shall be supported at its base and no greater than every story height, not to exceed 20 foot intervals.

B. Horizontal Piping (Suspended) shall be supported at each bend; at not more than five (5) foot intervals; except that pipe exceeding five (5) feet in length may be supported at not more than ten (10) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging and shall be made directly behind the bell or coupling, where possible, not near the center of the pipe.

C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.

D. Horizontal pipe and fittings six inches and larger shall be suitably braced to prevent horizontal movement. This should be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement.

E. Where components are suspended in excess of eighteen inches by means of non-rigid hangers, they should be suitably braced against movement horizontally, often called sway bracing.

3.3 LINE AND GRADE

A. Install gravity lines at uniform grade to low point after field verification of low point invert.

B. Run piping straight, plumb and grade in the direction indicated on the drawings.

3.4 JOINTING PIPE

A. All pipe lines shall be correctly aligned before joints are made.

B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.

C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.

D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply non-acid solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

E. Joining "NO-HUB" cast iron soil pipe and fittings shall be in accordance with recommended practices described by the coupling manufacturers.

F. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

G. Provide reducing fittings (reducing bushings shall not be used) where changes in pipe sizes occur.

H. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.

3.5 PIPE PROTECTION

A. Paint all uninsulated piping underground (except cast iron) with two coats of asphaltic paint (Manual wiping is not acceptable).

B. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polylene film or 15 lb. roofing felt.

C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. roofing felt.

3.6 TESTS

A. A water test shall be applied to the sanitary and storm drainage systems either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening and the system filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than 10 ft. head of water. In testing successive sections at least the upper 10 ft of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 ft of the system) shall have been submitted to a test of less than a 10 ft head of water. The water shall be kept in the system, or in the portion under test, for at least 30 minutes before inspection starts; the system shall then be tight at all points.

B. An air test shall be made by attaching an air compressor or testing apparatus to any suitable opening and after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 psi or sufficient to balance a column of mercury ten inches in height. This pressure shall be held without introduction of additional air for a period of at least 30 minutes.

C. Complete all field testing prior to insulation, wrapping and/or backfill.

3.7 VENT FLASHING

A. Extend lead type flashing 12" beyond pipe in all directions and carry to top of pipe with at least 2" return inside of pipe.

B. Install PVC pipe flashing in accordance with flashing manufacturer's recommendation.

C. Flashing for PVC piping shall be installed in accordance with manufacturer's instructions.

D. Install flashing materials as required by roofing system manufacturer's details and methods.

END OF SECTION

SECTION 15402

DOMESTIC COLD & HOT WATER SUPPLY PIPING & HOT WATER CIRCULATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide valves and specialties as specified under additional Sections of this Specification.

2.2 PIPE

A. The following schedule covers materials unless otherwise specified under a particular System Section.

1. Galvanized steel pipe, Schedule 40, ANSI B 125.2.
2. Copper tube, Type L, hard drawn, ASTM B 88.
3. Brass pipe or tube, chrome plated.

2.3 FITTINGS

A. Steel Pipe: Malleable iron 150 lb. banded, galvanized to match pipe.

B. Copper Tube: Wrought or cast brass solder joint.

C. The 'T' drill extruded fitting method may not be used.

D. Service material shall be brass compression fittings-angle ball cocks, ball corporations, etc. Flared fittings are acceptable under controlled conditions.

2.4 PIPE JOINTS

A. Joints in copper piping shall be made with tin-antimony solder (95-5) and non-acid flux. Contractor shall furnish manufacturers literature documenting that the lead content (trace quantities) are within the guidelines of the local codes having jurisdiction as well as the Safe Drinking Water Act Amendment (SDWAA).

B. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (seal-tite).

PART 3 - EXECUTION

3.1 GENERAL

A. The design drawings are generally diagrammatic. They do not show every bend, off-set, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.

B. Run all water lines parallel or perpendicular to building lines.

C. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.

D. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).

E. Minimum cover for exterior underground piping is three feet over insulation or conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive flanges, collars, and couplings. Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 24" has been deposited over pipe or conduit.

F. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second line with type of service below. Yellow tape is to be used for water, (Print type of water on tape; i.e., domestic cold water.)

3.2 HANGERS AND SUPPORTS

A. Vertical Piping shall be supported at its base and no greater than every story height.

B. Horizontal Piping (Suspended) shall be supported at not more than eight (8) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging.

C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.

3.3 JOINTING PIPE

A. All pipe lines shall be correctly aligned before joints are made.

B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.

C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound or tape on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.

D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

E. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

F. Run water supply main to point indicated on plans.

3.4 AIR CHAMBERS

A. 20 pipe diameters, but not less than 12". Provide at each fixture, risers and ends of supply lines.

3.5 WATER HAMMER ARRESTERS

A. Water hammer arresters (shock stops) shall be installed at the locations on the plans and in accordance with PDI Standard WH-201. Provide access panels so located to permit ease of service.

3.6 VALVES

A. Provide valves to isolate each riser, and branch line. See also Section 15460 for requirements.

3.7 REDUCERS

A. Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal, hot water piping shall be made with eccentric reducers. Top of hot water piping shall be flat for venting.

3.8 TESTS

A. Apply a water pressure test to all parts of the water supply system before the piping is concealed and before the fixtures and equipment are connected. Use a hydrostatic pressure of not less than 100 psig or 150% of system operating pressure, applied to the system for a period of four hours. There shall be no leaks at any point in the system at this pressure.

B. Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and approved. Make repairs of defects that are discovered as a result of inspection or tests with new materials. Caulking, welding or other such sealing methods of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.

C. Complete all field testing prior to insulation, wrapping and/or backfill.

3.9 STERILIZATION

A. As soon as the water piping has been thoroughly flushed out, sterilize the lines by introducing into them a solution of calcium hypochlorite or chloride of lime. Open and close all valves while system is being chlorinated. After the sterilizing agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 10 parts per million is indicated, repeat the process. When tests show at least 10 parts per million of residual chlorine, flush out the system until all traces of the chemical used are removed. Make necessary connections to sterilized piping.

3.10 PIPE PROTECTIONS

A. Paint all uninsulated piping underground with two coats of asphaltic paint. (Manual wiping is not acceptable)

B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polylene film or 15 lb. felt.

C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.

D. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

END OF SECTION

SECTION 15411

WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.

1.3 DEFINITIONS

A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.

B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. ASTM A 120-84 Specifications for pipe.
2. ASTM B 88-83A Specifications for seamless copper water tube.
3. ANSI B16.4 Fittings, Flanges, and Valves.
4. ANSI B16.22 Fittings, Flanges, and Valves.
5. ASSE 1003 and 1003-1 - Performance Requirements for Water Pressure Reducing Valves.
6. AWWA Cll0-82 Standard for Fittings, Flanges, and Valves.
7. AWWA C600 - Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
8. AWWA C110-82 Standard for Gaskets.
9. AWWA C601 - Standard for Disinfecting Water Mains.
10. PDI WH-201 - Water Hammer Arresters.
11. Plumbing Code Compliance: Comply with applicable portions of BOCA Basic National Plumbing Code.
12. ASME Compliance: Fabricate and stamp pressure- Standards of these Organizations, the more stringent regulations shall govern.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pipe in a manner to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and form work requirements are specified in Division 3.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.7 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide water distribution piping products from one of the following:

1. Balance Cocks:

a. Bell & Gossett ITT; Fluid Handling Div.
b. Taco, Inc.

2. Pressure Regulating Valves:

a. Cash (A.W.) Valve Mfg. Corp.
b. Spence Engineering Co., Inc.
c. Watts Regulator Co.

3. Water Meters:

a. Badger Meter, Inc.
b. Rockwell Intl.; Municipal & Utility Div.
c. Zurn Ind. Inc.; Hays Fluid Controls Div.

4. Relief Valves:

a. Cash (A.W.) Valve Mfg. Corp.
b. Watts Regulator Co.
c. Zurn Ind., Inc.; Wilkins-Regulator Div.

5. Water Hammer Arresters:

a. Amtrol, Inc.
b. Tyler Pipe; Sub. of Tyler Corp.
c. Zurn Ind., Inc.; Hydromechanics Div.

2.2 PIPE AND FITTINGS

A. Pipe Within Building (except below slab):

1. Pipe Sizes 2" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube; ANSI B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin-antimony solder.
2. Pipe Sizes Larger than 2": Galvanized steel pipe. Conform to ASTM Al20, Schedule 40, seamless, galvanized steel pipe; with mechanical grooved pipe couplings and fittings.

B. Pipes Inside and Outside Building, Below Ground:

1. PVC plastic water pipe. Conform to AWWA C900, for Class 100, Polyvinyl chloride (PVC) water pipe;/ AWWA Cll0, for Class 100, cast-iron or ductile-iron fittings; mechanical joints.

2.3 VALVES

A. Gate Valves: Refer to Section 15100.

B. Balance Cocks:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.
2. Soldered Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

C. Piping Specialties:

1. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
2. Basket Strainers: Cast-iron body, 125 psi flanges, bolted type or yoke type cover; with removable non-corrosive perforated strainer basket having 1/8" perforations and lift-out handle.
3. Flexible connectors: Stainless steel bellows with a woven flexible bronze wire reinforcing protective jacket; rated for 150 psig water working pressure, 250 degrees F operating temperature and suitable for up to maximum 3/4" misalignment. Connectors shall be a minimum of 12" long and have threaded or flanged ends; sweat ends are not acceptable.
4. Hose Bibbs: Bronze body, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet.
5. Sill Faucets: Bronze body, with renewable composition disc, wheel handle, 3/4" solder inlet, 3/4" hose outlet.
6. Recessed Non-Freeze Wall Hydrants: Cast-bronze box, with chrome plated face, tee handle key, vacuum breaker, hinged locking cover, 3/4" inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.
7. Pressure Regulating Valves: Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

D. Relief Valves:

1. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.
2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 180 degrees F, and pressure relief at 100 psi.

2.4 WATER METER

A. Water meter: Compound type, conforming to AWWA Standards. Size meter and arrange piping and specialties to comply with utility company requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

3.3 PIPING INSTALLATION

A. Refer to the separate Division 15 section: Basic Piping Materials and Methods, for general piping installation instructions.

B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.

C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement on, pump sizing, and other design considerations. So far as practical, install piping as indicated.

D. Install piping with 1/32" per foot (1/4 percent) downward slope towards drain point.

3.4 SERVICE ENTRANCE

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

C. Install shutoff valve at service entrance inside building; complete with strainer, pressure gage, and test tee with valve.

D. Ductile-Iron Pipe: Install in accordance with AWWA C-60.

3.5 ROUGH-IN FOR WATER METER

A. Install rough-in piping and specialties for water meter installation in accordance with utility company's instructions and requirements.

3.6 INSTALLATION OF VALVES

A. Installation requirements for general duty valves are specified in a separate section of Division 15.

B. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2" and smaller, use gate or ball valves; for sectional valves 2-1/2" and larger, use gate or butterfly valves.

C. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use gate or ball valve; for shutoff valves 2-1/2" and larger, use gate or butterfly valves.

3.7 INSTALLATION OF PIPING SPECIALTIES

A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain.

B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.

3.8 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide connection. For connections 2-1/2" and larger, use flanges instead of unions.

3.9 FIELD QUALITY CONTROL

A. Inspections:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform test specified below in the presence of the plumbing official.

    a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing official.
    c. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange System Test:

3. Test for leaks and defects all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
4. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

5. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
6. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.10 ADJUSTING AND CLEANING

A. Cleaning and Disinfecting:

1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

    a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
    b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
    c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
    d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.
    e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Reports:

1. Prepare reports for all purging and disinfecting activities.

END OF SECTION

SECTION 15420

DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section specifies building sanitary and vent piping systems.

B. Related Sections:

1. Separate sections in Division-2 specify sanitary sewage systems, and trenching and backfilling.
2. Separate sections in Division-7 specify flashing and sheet metal and joint sealers.
3. Division-15 Basic Mechanical Requirements section applies to the work of this section.
4. Separate sections of Division-15 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system requirements, pipe insulation, and plumbing equipment.

1.3 DEFINITIONS

A. Drainage System: Includes all the piping within a public or private premises which conveys sewage or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

B. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable portions of the Florida Building Code.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of flashing and roof penetrations.

B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

D. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Uniformity: Conform with the requirements specified in Basic Mechanical Requirements.

B. Drainage Piping Specialties, including expansion joints, drains, trap primers, and vandal-proof vent caps:

1. Josam Mfg. Co.
2. Zurn Ind.,Inc; Hydromechanics Div.
3. Wade Division, Tyler Pipe

2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

A. Hubless cast-iron soil pipe: Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.

B. Rain water leader piping above grade may be PVC meeting AWWA C900 Class 100. Joints shall be mechanical using elastomeric gaskets. Use of PVC in return air plenums (ie, office area) and through fire rated assemblies will not be permitted.

2.3 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

A. Pipe sizes 15" and smaller: Cast-iron soil pipe. Conform to ASTM A74, for Extra-Heavy weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

2.4 DRAINAGE PIPING SPECIALTIES

A. Trap Primers: Bronze body valve with automatic vacuum breaker, with ½" connections matching piping system, complying with ASSE 1018.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

D. Floor Cleanouts: Cast-iron body and frame, with clean-out plug and adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.
2. Cast-iron Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.

E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

H. Floor Drains:

1. Floor drain type designations and sizes are indicated on Drawings; See fixture schedules.

I. Roof Drain:

1. Roof drain type designations and sizes are indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS

A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

3.3 INSTALLATION

A. Refer to the separate Division-15 section: Basic Piping Materials and Methods, for general piping installation instructions.

B. Install supports and anchors in accordance with Division-15 Basic Mechanical Materials and Methods section "Supports and Anchors".

C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures

are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Make joints of "No-Hub" cast iron soil pipe with coupling assembly using torque wrench pre-set at 60 inch pounds.

F. Install Thrust blocks at the bottom of the waste stack, condensate stack and rain leader pipe.

G. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install expansion joints on vertical risers as indicated and as required by the plumbing code.

B. Above Ground Cleanouts: Install in above ground piping as indicated:

1. As required by plumbing code.
2. At each change in direction of piping greater than 45 degrees.
3. At minimum intervals of 50' for piping 3" and smaller, 75' piping 4" and larger.
4. At base of each vertical soil or waste stack.

C. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

D. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

E. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.5 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8" per foot (1 percent). Adjust trap primer for proper flow.

3.6 CONNECTIONS

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.7 FIELD QUALITY CONTROL

A. Inspections:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

    a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection by the plumbing official.

3.8 PIPING SYSTEM TEST

A. Test for leaks and defects all new drainage and vent piping systems.

B. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

C. Drainage and Venting System Testing Procedures:

1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

D. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.9 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.10 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 15421

FLOOR DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install floor drains including strainers and trap primers.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 DRAINS

A. Drains shall be of the type and materials as scheduled on the drawings.

B. Provide all necessary bolts, clamping rings and appurtenances to effect a complete installation.

C. The strainer size shall be as recommended by the manufacturer unless otherwise indicated on the drawings. The strainers shall be nickel alloy or polished brass. Provide tapped boss and trap primer floor drains as indicated on the drawings.

2.2 TRAP PRIMERS

A. Provide for all floor drains.

B. Units shall be cast bronze, with removable top cover, threaded or sweat pattern, and integral vacuum breaker.

C. Acceptable manufacturers are: Wade, Josam, Smith, MIFAB and Zurn.

PART 3 - EXECUTION

3.1 DRAINS

A. Install all drains in accordance with the manufacturer’s instructions.

3.2 TRAP PRIMERS

A. Trap primer outlet should extend vertically a minimum of 12" before a change in direction to horizontal is made. The horizontal line to the trap primer connection shall be installed sloping to the trap it serves. Provide a minimum size of 12" x 12" stainless steel access cover for each trap primer.

END OF SECTION

SECTION 15422

ROOF DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install roof drains including underdeck clamps and gravel guards as indicated on drawings.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drains shall be of the type and materials as scheduled on the drawings.

B. Provide all necessary bolts, clamping rings and appurtenances to effect a complete installation.

C. Roof drain bearing pan where required shall be by roof drain manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all drains in accordance with the manufacturer’s instructions.

B. Drain bodies required to be insulated shall be installed with sufficient clearances and accessibility to permit proper installation of the insulation material.

END OF SECTION

SECTION 15423

CLEANOUTS AND CLEANOUT ACCESS COVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

B. Alternates may be or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.2 SCOPE

A. Furnish and install cleanouts as shown on drawing or specified herein.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleanouts and cleanout access covers shall be of the type and materials as scheduled on the drawings.

B. Provide all necessary bolts and appurtenances to effect a complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all cleanouts and cleanout access covers in accordance with the manufacturers instructions.

B. Exterior cleanouts below grade shall be extended to finish grade. Pour a concrete pad 18" x 18" x 6" thick around cleanout; slope top down approximately 2" from cleanout to edge of pad so that edge of pad is flush with grade.

C. Cleanouts shall be of the same nominal size as the pipes to which they are connected up to 4" in diameter; and not less than 4" for larger pipes.

D. Cleanouts shall be provided at not more than 50 feet apart in horizontal drainage lines of 4" nominal diameter, and at not more than 75 feet apart for larger diameter pipe.

E. At change in direction: Cleanouts shall be provided at each change of direction of the building drain when the angle of change is 90 degrees.

F. At base of stacks: Cleanouts shall be provided at or near the base of each vertical stack.

G. Direction of cleanout: All cleanouts shall be installed so that the cleanout opens in a direction opposite to the flow of the drainage line, or at a right angle to the line.

H. Concealed cleanouts in wall shall be provided with removable access panel.

I. Where access cleanout boxes or covers are installed in the floor, the top surface shall be scoriated and the cover secured, but removable when necessary. Polished brass. Install carpet type covers in carpeted areas.

END OF SECTION

SECTION 15429

DOMESTIC WATER HEATERS: COMMERCIAL ELECTRIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install water heater including all valves, fittings, overflow drain pan, relief valve, heat trap and appurtenances.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

1.5 MANUFACTURERS

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Lochinvar
2. State Industries
3. A. O. Smith
4. Ruud

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water heater shall be of size, voltage and wattage as shown on drawings. Tank shall be 300 p.s.i. test pressure, 150 p.s.i. W.P. approved; glass lined, with 1.315 dia. "Dow" magnesium tank saver. Elements will be copper sheath, tin coated immersion type, low watt density (75 watts p.s.i. maximum). Tank shall be insulated to ASHRAE 90A-1980 energy efficiency standards. Heater jacket shall be heavy gauge steel with baked enamel finish. Internal wiring shall be composed of solid copper wire having an insulation material rated at 600 V, 200 C. Heater shall have a factory installed temperature and pressure relief valve.

B. Control Circuit:

1. Surface Mounted Thermostats: Individual thermostats with built-in manual reset hi limit providing staged control and over-temperature protection for each heating element.

2. Immersion Thermostats: Supplied with one magnetic contactor for each 18 KW increment. 120 volt control circuit with built in transformer.

C. Water heater shall be U.L. listed and approved and shall be fused in accordance with U.L. requirements.

D. Water heater to be size voltage and wattage as shown on drawings. Heater to be completely insulated and jacketed for (vertical) or (horizontal) installation. The jacket shall be rectangular 16-gauge galvanized steel with beige acrylic enamel finish. Jacket shall have a full-length hinged access door with key lock. Tank insulation shall be high-density fiberglass sufficient to meet ASHRAE 90A-1980 standards of 4 watts per square foot of tank surface maximum energy loss. Key lock door provides additional safety and security.

E. Tank construction shall be 300-pound test. 125-pound working pressure and be ASME stamped and National Board listed. All tanks are to be lined with vitreous glass, fired at 1600 F. provided molecular interchange of glass and steel. Manhole cleanout shall be standard on 500 through 2500 gallon models.

F. Handhole cleanout on heaters under 500 gallons heater shall include the following standard features: internal fusing for control and load circuits, built-in safety drain pan with piping connections, low-watt density incoloy sheath elements, ASME rated temperature and pressure relief valve, terminal block wiring, 180^{o}F water temperature approval, U.L. listing, 3 year limited warranty.

G. Control system: Individual thermostats with built in manual reset hi limit providing staged control and hi-limit safety for each heating element. (Not available on horizontal models) -OR-

H. Magnetic contactors with immersion thermostat: 120 volt control with built in transformer.

I. The discharge from the relief valve shall be piped full-size separately to the outside of the building or to another approved terminal as provided for safety pan drain terminals but in no case shall the discharge from a relief valve be trapped.

J. Provide magnesium storage tank savers.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide gate valves on both the incoming cold water and leaving hot water supply piping.

B. Cold water supply shall also be equipped with a check valve down stream of the gate valve. Remove flapper from check valve and drill a 1/16 inch hole in flapper. Replace flapper in valve body.

C. Provide unions to facilitate replacement of the storage tank and/or heater.

D. Heat trap shall be installed in the hot water supply piping.

END OF SECTION

SECTION 15440

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections:

1. Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division-10.

C. This Section specifies plumbing fixtures and trim. The types of fixtures specified included the following:

1. Lavatories (including wheelchair type);
2. Service Sinks;
3. Water Closets;
4. Urinals;
5. Mop Basins;
6. Drinking Fountains;
7. Faucets;
8. Flush Valves;
9. Fixture Supports (including wheelchair type);
10. Toilet Seats;
11. Electric Water Heater;

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."
2. ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers."
3. ANSI Standard All7.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
4. Public Law 90-480: "Architectural Barriers Act of 1968."
5. UL Standard 399: "Drinking-Water Coolers."

B. Delivery, Storage, and Handling:

1. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.
2. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

C. Sequence and Scheduling:

1. Schedule rough-in installations with the installation of other building components.

1.3 MAINTENANCE

A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity shall be as specified in Section 15010: Basic Mechanical Requirements under Product Options.

1. Subject to compliance with specified requirements, provide plumbing fixtures of one of the following:

a. Lavatories, Service Sinks, Water Closets, Urinals, Bath Tubs:

(a) Crane Co.
(b) Eljer Plumbingware Div.; Household International Co.
(c) Kohler Co.
(d) American Standard.

b. Faucets:

(a) Chicago Faucet Co.
(b) Eljer Plumbingware Div.; Household International Co.
(c) Kohler Co.

c. Flush Valves:

(a) Sloan Valve Co.
(b) Zurn Industries, Inc.; Hydromechanics Div.

d. Water Closet Seats:

(a) Bemis Mfg. Co.
(b) Beneke Corp.

e. Water Coolers:

(a) Elkay Mfg. Co.
(b) Filtrine Manufacturing Co.
(c) Haws Drinking Faucet Co.

f. Service Sinks:

(a) Crane Co.
(b) Eljer Plumbingware Div.; Household International Co.
(c) Kohler Co.

g. Fixture Supports:

(a) Josam Mfg. Co.
(b) Kohler Co.
(c) Zurn Industries, Inc.; Hydromechanics Div.

2.2 FIXTURES (See schedule)

2.3 WATER COOLERS (See schedule)

2.4 FAUCETS (See schedule)

2.5 FLUSH VALVES (See schedule)

2.6 FIXTURE SUPPORTS (See schedule)

2.7 ELECTRIC WATER HEATER (See schedule)

2.8 FITTINGS, TRIM AND ACCESSORIES

A. Toilet Seats: elongated, solid white plastic, closed back/open front, less cover, and having stainless steel check hinge and replaceable bumpers.

2.9 ESCUTCHEONS

A. Chrome-plated cast brass with set screw.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of ANSI All1.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Set shower receptor and mop basins in a leveling bed of cement grout.

E. Install a stop valve in an accessible location in the water connection to each fixture.

F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

G. Seal fixtures to walls and floors using silicone sealant as specified in Section 07900. Match sealant color to fixture color.

3.3 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.4 ADJUSTING

A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

B. Replace washers of leaking or dripping faucets and stops. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.5 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.6 PROTECTION

A. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

3.7 ROUGH-IN SCHEDULE (Refer to Drawings)

3.8 MOUNTING HEIGHTS SCHEDULE

Fixture	Mounting Height
Water Closet	15" floor to rim
Wheelchair Water Closet	18" floor to rim
Standard Urinals	22" floor to rim
Adult Standard Water Cooler	40" floor to rim
Wheelchair Water Cooler	35" floor to rim
Adult Standard Drinking Fountains	40" floor to rim
Wheelchair Drinking Fountain	35" floor to rim

END OF SECTION

SECTION 15450

PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install plumbing fixtures indicated on drawings or specified herein.

B. All plumbing fixtures shall be "First Quality" as defined and set forth in Commercial Standard CS77-28 as promulgated by the U.S. Department of Commerce. All fixtures are to be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.

C. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specifications.

D. Fixtures and fittings proposed shall be from one manufacturer and of similar character in any room or location. Escutcheons, handles, etc., on the different fixtures shall be of the same design.

E. The fixture numbers and types are scheduled on the drawings, and are used to indicate type and quality of fixtures desired. Acceptable fixture manufacturers are as follows: American Standard, Eljer and Kohler. Fixture manufacturers not listed herein will be considered subject to the general requirement outlined in Section 15010 Mechanical General Provisions.

F. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flush valves and water closet seats shall be as scheduled on the drawings.

B. All exposed metal not otherwise specified shall be polished chromium on brass or bronze. All supply valves shall have renewable seats and discs. All hot and cold water supply to fixtures shall be provided with stops. Provide P-trap with cleanout for each lavatory and sink except as specifically noted.

C. All seats shall be solid, white, open front seat with checking and self sustaining, stainless steel hinge.

D. Chair carriers and combination chair carriers and fittings shall be as scheduled on the drawings.

E. Chrome-plated. Provide where exposed piping passes through finished surfaces. Escutcheons for extended sleeves shall be of the type designed for that purpose.

F. Provide a concealed hanger type lavatory chair carrier with short foot mounted in the chase to support lavatories shown on walls of a chase.

G. Provide through toggle bolts, 1/8" thickness steel backing plate, and wall hangers for support of lavatories on 6" or thicker concrete block walls.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Layout fixtures as indicated on the drawings.

B. Carefully install fixtures in accordance with manufacturer's data with sufficient clearances to coordinate with accessories, specialties and equipment specified in other divisions of these specifications and/or as shown on the drawings.

C. Hangers and carriers shall be installed in accordance with manufacturer's recommendations and in accordance with good practice and workmanship.

D. Clean all exposed metal surfaces from grease, dirt, paint or other foreign material.

E. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specification.

F. Fixtures, chrome-plated piping, fittings and trim shall be polished before requesting acceptance of the system.

END OF SECTION

SECTION 15460

VALVES, COCKS AND SPECIALTIES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install valves, cocks and specialties as indicated on drawings or specified herein.

B. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed by subcontractor in an approved manner and location. Pressure ratings given for valves are steam working pressure. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equal material and pressure class will be accepted.

C. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 WATER MAIN VALVES

A. Water main valves are to be AWWA approved, gate valve, double disc, iron body, bronze trim, non-rising stem, flanged end, with 2" square wrench nut. Valve boxes are to be cast iron adjustable type for top flush with ground surface. Furnish a box for each underground valve shown on drawings.

Valves	Valve Boxes
Mueller No. A2380-6	Alabama Pipe Co. E2602
Stockham Fig. G-745	James B. Clow F2450
Crane No. 462	Mueller H10360

2.2 BALL VALVES

A. 2-1/2- inches and smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers: Crane, Hammond, Jamesbury, Nibco, Stockham, and Walworth.

2.3 LAWN FAUCETS

A. Lawn Faucets to be rough nickel plate, lock shield compression stop with removable handle, solid flange, female connection, with 3/4 inch male threaded hose end with anti-syphon device.

	1/2" Inlet	3/4" Inlet
Mueller Co.	H-8297	H-8297
Hammond	1000	1000
Chicago Faucet	293	387

,OR.

B. Provide integral or separate stop for lawn faucet.

,OR.

C. Lawn Faucets shall be as scheduled on the drawings.

2.4 GATE VALVES (THREADED)

A. 3" and smaller threaded valves and 4" and smaller solder pattern valves, rising stem, iron wheel, rough brass body, solid wedge disc, screwed or union bonnet and finished gland nut - 150 psi class.

Threaded Pattern	Soldered Pattern
Crane 431	- - -
Powell 514S	1842S
Walworth 56	- - -
Lunkenheimer 2151	3150
Stockham B-122	B-124

2.5 GATE VALVES (FLANGED)

A. 3-1/2" and larger; except for solder valves as noted above shall be flanged type with cast iron body, brass trim, brass seats, rising stem and iron wheel - 125 psi class.

Flanged Pattern
Crane 465-1/2
Powell 1793
Walworth 726F
Lunkenheimer 1430
Stockham G-623
or approved equivalent

2.6 CHECK VALVES (SWING)

A. Check valves 3" and smaller shall have a pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check with rough brass body, finished gland nut and regrinding bronze disc.

B. Check valves larger than 3" shall be flanged pattern, 125 psi iron body swing check with renewable brass seat, disc and trim. Check valves on primary heating hot water or chilled water piping system shall be 200 psi WP brass or ferrosteel body swing check valves, with renewable brass seat, disc and trim.

	Flanged Pattern	
	125 psi	200 psi
Crane	373	39E
Powell	559	576
Walworth	M-928F	M-970F
Lunkenheimer	1790	323
Stockham	G-931	---

2.7 CHECK VALVES (WAFER)

A. Check valves 3" and larger flanged pattern shall have a pressure rating of 125 psi, globe type body, semm. steel body, stainless steel spring, bronze disc and bronze seat ring.

Williams-Hager	Figure 636
APCO	Series 600
Mueller	Nos. 105, 107, 109 and 113
Metraflex	Series 900

B. Check valves on primary hot water piping systems shall be 200 psi, globe type body, semi steel body, stainless steel spring, bronze disc and bronze seat.

2.8 COCKS

A. Provide tight shut off balancing cocks at locations indicated on drawings.

B. Cocks 2" and smaller, square head bronze cocks 125 psi class with check.

Crane 254
Powell 955
Walworth 554
Lunkenheimer 454,
or approved equal

C. Cocks over 2", lubricated plug valves with semi-steel body 175 psi class.

Screwed 2" and 3"	Flanged 4" and over
Powell F 2200	Powell F 2201
Walworth 1700	Walworth 1700F
ACF R 1430	ACF R 1431

or approved equivalent

D. Lubricated plug cocks over 6" shall have a geared or worm drive operator.

E. Lubricated plug cocks may be used in lieu of globe or gate valves on heating hot water or chilled water steel piping systems to facilitate installation of insulation. All 6" or smaller chilled water piping valves located above finished ceilings (unless located over drip pan), or below ceiling in a finished area of the building shall be lubricated plug cocks. Provide handle or operator for each valve.

2.9 BUTTERFLY VALVES

A. Butterfly valves may be used in lieu of gate valves or throttling valves when indicated on the drawings.

1. Design working pressure and temperature 150 psig and 180^{o}F.

2. Materials of construction:

a. Body: Malleable or ductile iron
b. Disc: Aluminum bronze
c. Stem: 416 stainless steel
d. Bushings: Bronze
e. Seat: Compound 230 Buna N or as per manufacturer's recommendation for specific service.
f. Handle: Lever lock through 10" size, if valve is to be used for throttling service, provide infinite adjustment throttle plate.

B. Valves used for the isolation of equipment or for future connections shall have flanged ends or flange unions to permit removal of equipment and/or piping with the valve remaining in service.

C. Acceptable manufacturers are Keystone, Center Line or Demco.

2.10 BACK FLOW PREVENTER (REDUCED PRESSURE)

A. 3/4" to 4" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have all bronze construction, stainless steel internal parts, test cocks and suitable for 175 psi supply water pressure. Unit shall be furnished with factory mounted bronze inlet strainer, union and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

B. 4" to 6" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have iron body construction, epoxy coated internal water way, stainless steel internal parts, test cocks and stainless steel bolts. Unit shall be furnished with inlet strainer and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

2.11 BACK FLOW PREVENTER (DOUBLE CHECK VALVE)

A. 3/4" to 2"; ASSE Std 1015, AWWA Std. C-506; unit shall have bronze body, stainless steel internal parts, test cocks and rubber seating check valves. Unit shall be furnished with factory mounted bronze inlet strainer, union, and non-rising stem gate valves (on inlet or outlet). Watts Series 700 Beeco, or approved equal.

B. 2-1/2" and 3"; ASSE Std. 1015, AWWA Std. C-506; unit shall have iron body, stainless steel internal parts, test cocks, and rubber seating check valves. Unit shall be furnished with flanged ends, factory mounted inlet strainer, union, stainless steel bolts and non-rising stem gate valves (on inlet and outlet). Watts Series 700 Beeco or approved equal.

2.12 DIELECTRIC UNIONS

A. Epco Sales, Inc., 3204 Sackett Avenue, Cleveland, Ohio; Capitol Manufacturing & Supply Company, Columbus; Patrol Valve Company, Cleveland, Ohio, or approved equal.

2.13 FLEXIBLE METAL HOSE

A. American Brass Co., Mason Industries, Chicago Metal Hose Co., or approved equal, 300 psig WP design flexible metal hose constructed of brass with brass wire braid covering.

2.14 FLEXIBLE PLASTIC PIPE JOINTS

A. Resist-O-Flex Co., Mercer Rubber Co., La Favorite Co., or approved equal, multiple bellows, guides, and restraining bolts or blocking. Joints shall be rated at 150 psig and 220^{o}F continuous service.

2.15 STEEL PIPING SYSTEM STRAINERS

A. Malleable or cast iron, 125 psig working pressure. Free area of strainer - not less than 300 per cent cross sectional area of pipe. Strainer mesh, perforation size, and pattern as follows:

Pipe Size	Pattern	Mesh or Perforation Diameter
to 2 in.	threaded wye	20 mesh
2 to 4 in.	threaded wye	0.045 inch dia.
5 to 10 in.	flanged wye	0.125 inch dia.
12 in. up	flanged basket	0.125 inch dia.

2.16 COPPER PIPING SYSTEM STRAINERS

A. Copper piping system strainers solder pattern with removable bolted flange on strainer leg. Strainer 40 mesh bronze screen, with free area of screen at least 3 times cross sectional area of pipe.

2.17 ACCESS PANELS

A. Access panels (Milcor) Inland-Ryerson Construction Products Co., (Boico) Birmingham Ornamental Iron Co., or approved equal. Steel panels and frames shall be furnished with prime coat of rust inhibitor enamel. See plans for sizes (12 x 12) min.). Access panel styles as follows:

	Milco	Boico
Fire rated	1-1/2 hr. B. Label	1-1/2 hr. B. Label

2.18 SAFETY VALVES

A. Safety Valves to be Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co., ASME rated as shown on the drawings and/or required by applicable codes.

B. Refrigerant Safety Valves in accordance with USASI Code for refrigeration apparatus, and pipe discharge outside building.

C. Protect water heaters with Watts, Beaton Cadwell or McDonnell Miller, combination automatic temperature and pressure relief valves (with manual lift lever). Relief capacity shall exceed input energy at 125 psig pressure and 210^{o}F temperature.

2.19 AUTOMATIC AIR VENTS (AAV)

A. Automatic Air Vents to be equal to:

(150 psig W.P)	(75 psig W.P)
Metraflex MV-15	Maid-O-Mist 7
Crane Co. 976	Bell & Gossett 7
Sarco 13W	Hoffman 79
Armstrong 1AV	

2.20 MANUAL AIR VENTS (MAV)

A. Manual air vents shall be brass manual cock equal to Crane 700 series.

2.21 WATER HAMMER ARRESTERS

A. Water hammer arresters (shock stops) shall be equal to those manufactured by Josam Manufacturing Company, Zurn Industries, Inc., Wade, Inc., MIFAB or Jay R. Smith Manufacturing Company.

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves and cocks in horizontal piping with the valve stem in the vertical upright position.

B. Install valves and cocks to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

*

C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

3.2 ACCESS PANELS

A. Furnish adequate number of properly sized access panels (12" x 12" minimum size) to adequately service and maintain systems installed under each section of specifications.

B. Access panels shall be installed and painted under other divisions of these specifications. Exact panel location shall be designated by the subcontractor performing the work of this Section.

C. Access panels are not required in exposed grid or other types of readily removable ceilings.

D. Access panels shall not compromise the fire rating of the wall.

3.3 SAFETY VALVES

A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

3.4 AUTOMATIC AIR VENTS

A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

3.5 WATER HAMMER ARRESTERS

A. Install water hammer arresters (shock stops) at the locations indicated on the plans and in accordance with size and placement recommendations given in Plumbing and Drainage Institute Standard PDI-WH201.

3.6 BACKFLOW PREVENTERS

A. Water service back flow preventers shall be installed above grade and in such a manner to prevent the discharge relief opening from becoming submerged by ground water. Provide suitable protection to prevent assembly from freezing.

END OF SECTION

SECTION 15465

INSULATION FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification Sections, apply to work of this section.

1.2 SCOPE

A. Above grade domestic hot water supply and recirculating piping.

B. Blow grade domestic hot water supply and recirculating piping.

C. Above grade waste lines and trap from ice machines and waste lines receiving condensate from air conditioning units to a point of connection to a soil line receiving waste from 4 or more plumbing fixtures.

D. Interior storm water piping.

E. Above grade domestic cold water piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.

F. Above grade exterior domestic cold water piping.

G. Handicap lavatory exposed hot water and waste piping.

H. Above grade fire protection piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.

I. Above grade domestic chilled water piping.

J. Below grade domestic chilled water piping.

K. Domestic water chilled evaporator, chilled water compression or expansion tank; and other cold surfaces with operating temperatures of less than 70 degrees F.

L. Domestic chilled water pumps.

M. Above grade water piping exposed in unheated areas.

N. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-15 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials listed in subsequent paragraphs of this specification are those used as basis of design; alternate manufacturer's equivalent projects as listed herein will be accepted. The insulation contractor shall verify materials and comply with requirements of NFPA 90, with regard to a flame spread rating of 25 or less and; a smoke developed/fuel contributed value of less than 50.

2.2 MATERIALS

A. Insulation and accessory materials to be as manufactured by the listed manufacturers or approved equal:

1. Calcium Silicate: Owens Corning "Kaylo", Manville "Thermo-12".
2. Fiberglass: Owens Corning, Knauf, CertainTeed, or Manville.
3. Foamed Plastic Insulation: Armstrong "Armaflex", U.S. Rubber "Ensolex", Gustin Bacon "Ultra-Foam", Owens Corning "O-C" Halstead Industrial Products, or approved equal.
4. Cellular Glass: Fed. Spec. HH-I-551a.
5. Extruded Polyethylene Insulation: Nomaco Inc. "Thermacell, Sentinel Energy Savings Products Division of Packaging Energy Groups, Inc., "Senflex" or approved equal.
6. Insulating Finish Cement: JM No. 301, BH Improved Super Powerhouse Cement, The Ruberoid Co., No. 412, or approved equal.
7. Mastics, Sealers and Adhesives:

	Benjamin Foster	Insulcoustic	Childers	J-M
Cellular glass bedding mastic	30-45	40-10	CP-70	
General purpose mastic	35-00 Series Vi AC Mastic		CP-10	375
Vapor barrier sealant (indoor)	30-35	IC-501	CP-30	
Adhesive	85-20		CP-89	
Fire retardant sealer (outdoor)	60-35	IC-531		
Foamed Plastic & Adhesive				57
Extruded Poly-ethylene	Therma-Cel 950 Adhesive			

8. Pipe Jacketing and Valve Covers (Ultra Violet Resistant): Zeston PVC, CEEL-Tite, Proto Corp. (Lo Smoke), or approved equal.
9. Metal Jacketing and Fitting Cover: Aluminum 0.016 gage (minimum) smooth or corrugated, Childers Products Co., General Aluminum Supply Co. (Gasco), Alcorjac by Insulcoustic Co., or approved equal.
10. Molded Fiberglass Fitting Insulation: Molded Acoustical Products, Inc., West Easton, PA, 18042 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Insulation is not to be installed until the piping systems have been checked and found free of all leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.

B. Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end. Insulate pipe anchors adequately to prevent moisture condensation problems.

C. Insulation installed in exposed locations such as water heater rooms, equipment rooms, air handling unit rooms, all exterior above grade areas, kitchens, laundries, power houses, utility buildings, energy building or similarly identified locations where the insulation would be subject to physical damage shall be covered with metal jacketing. Elbows may be covered with fire rated and ozone resistant (for exterior locations) PVC covers in lieu of metal jacket.

3.2 WARM OR HOT SURFACES

A. Insulate interior warm or hot surfaces with an operating temperature of over 120 degrees F and less than 400 degrees

B. These surfaces include hot water storage heater.

C. Insulate with 1-1/2" thick calcium silicate blocks, securely wired on and covered with poultry wire. Apply a finish coat of 1/2' insulating finish cement over the poultry wire. Trowel the exterior smooth.

D. Insulate hot surfaces operating at over 100 degrees F temperature with 3/4" V-rib spacing lath and 1-1/2" molded 85% magnesia or calcium silicate blocks wired on over the spacing lath. Apply poultry wire over the magnesia blocks and give a 1/2" coat of insulating finish cement. Trowel the exterior smooth.

3.3 EMERGENCY GENERATOR MUFFLER AND EXHAUST PIPING

A. Shall be insulated with two 1-1/2" layers of calcium silicate block insulation. All joints shall be staggered and the blocks shall be installed with corrosive resistance stainless steel tie wires. The insulation shall be finished with a skim coat of Johns-Manville hydraulic setting insulation cement and covered with a layer or Underwriters grade cloth. The cloth shall be sized with Foster's 30-36 fire retardant coating or equal.

3.4 COLD SURFACES

A. Cold surfaces with operating temperatures below 70 degrees F to be insulated with 1" thickness foamed plastic or extruded polyethylene insulation. Surfaces include, but not limited to, domestic water chiller, domestic chilled water air separator, domestic chilled water expansion tank, domestic chilled water pump, and refrigerant suction line intercooler. The foamed plastic sheets shall be applied over a heavy coating of Johns-Manville #57 adhesive. The insulation shall be finished with a heavy coat of white aerotube finish.

3.5 CONDENSATE PIPING FROM ICE MACHINES

A. Insulate condensate piping and waste lines from ice machines with foamed plastic insulation or extruded polyethylene, one-half inch thickness.

B. Mitre cut insulation to fit the pipe fittings. Use approved cement to seal all joints, seams, and ends in the insulation.

3.6 HORIZONTAL RAIN WATER PIPING

A. Shall be insulated with 1/2" thickness fiberglass pipe insulation. Prior to installing with insulation the pressure release paper shall be removed from the jacket laps. Pipe insulation shall be secured in place by applying pressure to the pressure sensitive closure system. Elbows shall be insulated with fiberglass inserted into 25/50 rated PVC (Aluminum) fitting covers.

B. Insulation shall begin at the base of roof drain body and include piping elbows at change of directions from vertical to horizontal.

3.7 HORIZONTAL WASTE PIPING RECEIVING AIR-CONDITIONING CONDENSATE

A. Shall be insulated with 1" thickness AP-T fiberglass pipe insulation. Prior to installing with insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with white open weave glass fabric.

3.8 DOMESTIC CHILLED WATER PIPING

A. Insulate domestic chilled water piping as described in these paragraphs with cellular glass. (Cellular glass with a factory applied glassfab jacket is acceptable.) Mitre cut insulation and carefully fit to the pipe fittings. Piping 6 inch and smaller, use 1-1/2" thickness insulation; piping over 6 inch diameter, use 2" thickness insulation. All cellular glass shall be shop bore-coated with Keen's cement prior to shipment to the job site. All pipe insulation joints shall be buttered with Foster's GPM 3500 or equal. The insulation sections shall be wired in place with 16 gauge copper or stainless steel wires spaced approximately 9" on center. Valves and fittings shall be insulated with prefabricated or pre-formed sections of cellular glass insulation and finished the same as adjacent piping.

B. Finish cellular glass insulation in concealed locations by applying a heavy coat of Foster's GPM 3500 vapor barrier sealant a to the exterior surface of the cellular glass. Embed a layer of open weave glass fabric cloth in this sealant overlapping seams at least 2". Apply a finish coat of Foster's GPM 3500 and finish as smooth as possible. Note: Two coats of sealer will be required where factory applied glassfab jacket is used.

C. Finish cellular glass in exposed interior locations such as air handling unit equipment rooms, boiler rooms, and chiller room as follows:

1. Straight runs of 2" piping and larger - cover with 0.016" thickness smooth aluminum weatherproof jacket with factory applied integral vapor barrier. Piping 2" and smaller - 0.010" thickness aluminum jacket with integral vapor barrier. Seal joints to preserve integrity of vapor barrier. Fasten jacket with 1/2" wide aluminum bands on not over 12" centers. Elbows, tees, reducers, valves and other special fittings - use prefab jacket.

3.9 UNDERGROUND PIPING

A. Insulate all underground domestic hot and chilled water piping with 1-1/2" thickness cellular glass preformed split sectioned pipe insulation.

B. Mitre cut insulation and carefully fit to the pipe fittings. All cellular glass to be shop bore-coated with Keen's cement prior to shipment to the job site. Apply cellular glass bedding mastic to all edges of the cellular glass insulation to fill any voids between joints in the insulation.

C. Wire the Cellular glass in place with stainless steel or copper wire 9" on centers. Expansion joints in the insulation with 1/4" clearance shall be made 10' on centers. The expansion joints shall be filled with asphalt impregnated felt and covered with the jacket.

D. Apply a heavy coat of vapor barrier sealant to outside of the cellular glass and embed a layer of open mesh glass fabric cloth into the mastic; carefully apply the cloth smoothly and overlap all transverse and longitudinal joints at least 2". Apply a second heavy and final coat of mastic over the cloth and finish to a reasonably smooth surface.

E. All legs of underground expansion loops and expansion ells shall be additionally covered with 2" thickness fiberglass 7-1/4 pounds per cubic foot density fiberglass pipe insulation applied under the cellular glass and under the glass fabric.

3.10 ABOVE GROUND DOMESTIC COLD WATER, DOMESTIC HOT WATER AND DOMESTIC HOT WATER RECIRCULATION PIPING

A. Shall be insulated with ASJ fiberglass pipe insulation. Prior to installing the insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with molded fiberglass pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with a layer of white open weave glass fabric.

B. Main pipe sizes 2-1/2" and smaller shall have 1" thickness insulation unless noted on the drawings.

C. Pipe sizes 2-1/2" and larger shall have 1-1/2" thickness insulation.

D. Branch runouts up to 2" shall have 1/2" thickness insulation.

3.11 HANDICAP LAVATORY EXPOSED HOT WATER AND WASTE PIPING

A. Shall be insulated with foamed plastic insulation or extruded polyethylene, one-half inch thickness.

B. Mitre cut insulation to fit the pipe, fittings and stops.

C. Use approved cement to seal all joints, seams, and end in the insulation.

END OF SECTION

SECTION 15671

CONDENSING UNITS: AIR COOLED HERMETIC

PART 1 - GENERAL

1.1 SCOPE

A. Provide packaged hermetic air cooled condensing units of the capacity, operating characteristics, and electrical characteristics indicated on drawings and specified herein.

1.2 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete data on: unit dimensions; minimum operating and service clearances; capacities and rating conditions; maximum operating weights; power consumption; power and control wiring (both factory and field); and operating and safety controls.

1.3 MANUFACTURER

A. Design Basis: As scheduled.

B. Acceptable: Carrier, Trane, Weatherking, York, Rheem or equal.

1.4 COMPATIBILITY

A. Each unit must be compatible with evaporator coil arrangements and associated controls to which connected equipment is interfaced.

PART 2 - PRODUCTS

2.1 FRAME

A. Unit shall be completely factory assembled with all components mounted on a steel frame.

2.2 FINISH

A. The frame, all structural members, and sheet metal panels shall be properly cleaned, painted with a zinc rich primer, and finished with alkyd enamel.

2.3 COMPRESSOR AND MOTOR

A. The unit compressor(s) shall be of the hermetic reciprocating type with crankcase heater.

B. Motor shall be suction gas cooled and sized for continuous operation over the full range of operating conditions indicated and with voltage variations indicated in the National Electric Code. Motor running protection shall be provided by temperature sensors embedded in the motor windings and by thermal overload relays.

2.4 CONDENSER

A. Seamless copper tubes with mechanically bonded aluminum fins.

2.5 CONDENSER FANS

A. Direct drive, propeller type with fan guards. Fan motors shall have thermal overload relays for running protection.

2.6 FACTORY PREWIRING

A. Unit shall be factory wired with power connections brought out to a single set of terminal lugs for field connection.

PART 3 - EXECUTION

3.1 UNIT PLACEMENT

A. The unit location shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the equipment approved for actual installation on this project.

3.2 COORDINATION

A. Refer to Sections describing refrigerant piping systems and air handling units with DX refrigerant coils. Provide all piping, hangers, supports, valves, and specialty items as required for a complete and operable system.

3.3 VIBRATION CONTROL

A. Refer to Section entitled "Vibration Isolation" for vibration control.

3.4 TEST AND BALANCE

A. Refer to Sections describing tests and balancing.

END OF SECTION

SECTION 15778

DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ductless split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for fully exposed or partially concealed mounting, and may be connected to small branch and outside air ducts.

1.2 SUBMITTALS

A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within the following specified number of years from date of Substantial Completion:

1. Entire unit: 1 year parts and labor.
2. Compressor: 5 years parts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of design: As scheduled.
2. Carrier Air Conditioning; Div. of Carrier Corp.
3. Mitsubishi Electronics America, Inc.; HVAC Division.
4. Sanyo Fisher (U.S.A.) Corp.
5. Daikin.

2.2 EVAPORATOR-FAN UNIT

A. Exposed, Wall Mounted Unit Cabinet: Fabricated of cold roll steel with structural stiffness.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated.
3. Intake Grille: High impact polystyrene air inlet panel.
4. Discharge Grille: High temp noryl.

5. Evaporator Fan: Tangential type.

B. Partially Concealed Ceiling Mounted Unit Cabinet:

1. Chasis: Galvanized steel.
2. Fascia: High impact polystyrene.
3. Drain Pans: Galvanized steel, with connection for drain; insulated.
4. Evaporator Fan: Backward curved centrifugal.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

D. Electric Coil: Helical, nickel-chrome, electric-resistance heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

E. Fan Motor: Multispeed.

F. Filters: Permanent, electrostatic, cleanable.

G. Condensate Pump: Where scheduled.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed reciprocating or scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor..

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Where multizone units are specified, each compressor and circuit shall be sized properly for each evaporator.

2.4 ACCESSORIES

A. Thermostat: Provide with optional remote. Low voltage with subbase to control compressor and evaporator fan.

B. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

C. Infrared Control: Provide with factory infrared controls and remote operator.

D. Time Delay: Provide with short cycle time delay.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

B. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install roof-mounted, compressor-condenser components on equipment supports equal to Pate ER. Anchor units to supports with removable, cadmium-plated fasteners.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch.

3.2 CONNECTIONS

A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

B. Connect supply and return water coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

C. Connect supply and return condenser connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

D. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 15790

HEATING COILS: ELECTRIC DUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide factory assembled and prewired electric duct heaters where indicated. Heater capacities, sizes and operating characteristics shall be as scheduled on drawings or as indicated in other sections.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on heater sizes; required clearances; direction of air flow; control box construction and dimensions; power and control wiring (both factory and field); operating and safety controls; and capacities and operating characteristics.

1.5 MANUFACTURERS

A. Equipment items listed in the schedule on the drawings are based on a specific manufacturer to establish the desired style, quality, performance, and type of equipment. Equal products, complying with the required installation shown on the plans and with these specifications, by the following manufacturers are acceptable:

1. Brasch
2. Tennessee Plastics
3. Indeeco
4. Electric Heaters Division of I.T.E.
5. Valley Industries
6. Dell
7. Heatrix

PART 2 - PRODUCTS

2.1 GENERAL

A. Each heater shall be UL listed for zero clearance, open coil slip-in type for duct mounting. Sizes, direction of air flow, mounting position, electrical characteristics, and heating capacities shall be as indicated.

1. Meet all applicable requirements of current NEC.
2. UL listed including all built-in components.
3. Be entirely suitable for installation in the indicated locations (ductwork or air handling unit(s) as applicable).

4. Coordinated with the specified requirements of the mechanical system control system.

2.2 MATERIALS AND CONSTRUCTION

A. Galvanized or aluminized steel frame and terminal box with hinged cover.

B. Maximum watt density of 35 watts per square inch of resistance wire surface area (unless otherwise specified).

C. Terminals recessed into air stream 1-1/4 inches minimum.

D. Stainless steel resistance coil terminals and nuts.

E. Iron free resistance wire of 80% nickel and 20% chromium.

F. Reinforced resistance wire bracket supports spaced no greater than four inches apart with stiffening ribs and gussets.

G. Securely positioned terminal insulators and bracket bushings of high quality ceramic.

H. Dielectrically tested for 1000 volts plus twice the rated voltage of 2000 volts, whichever is greater.

I. Heat limiter in each energized heating element power line.

J. Balanced three phase delta connected load if three phase heaters are specified.

K. Insulated terminal box to prevent condensation.

L. Full fine break mercury contactors which will break all ungrounded conductors (note horizontal, vertical or oblique position of each heater assembly as shown on drawings).

M. Transformer with primary fusing if control voltage is different from supply voltage.

N. Overcurrent protection consisting of automatic circuit breaker(s) each installed in accord with NEC requirements.

O. Manual reset thermal cutout in series with a disc type, automatic reset thermal cutout for primary protection, and heat limiters in the heating element power lines to de-energize the elements if the primary cutout fails. Devices shall be serviceable through the terminal box without having to remove heater from duct.

P. Control terminals and power terminals.

Q. Pneumatic-electric switches (one per heater step) when control signal is pneumatic.

R. Built-in or remote pressure type air flow switch. Install in series with automatic reset thermal cutout.

S. Factory mounted integral disconnect switch.

PART 3 - EXECUTION

3.1 GENERAL

A. Arrange and install heater to provide uniform heating of air stream.

B. Properly and firmly support in each location.

3.2 PLACEMENT

A. Heater locations shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the equipment actually approved for installation on this project. Heaters and all controls shall be arranged for horizontal or vertical, top, side or bottom mounting as indicated on drawings. Heater installation shall conform to all governing codes as to clearances, disconnect means, wiring, and like items.

B. Support: Provide duct hangers, and specified in section entitled "Ductwork", immediately adjacent to both sides of heater at both sides of the duct.

C. Duct Openings: Shall be accurately cut, properly reinforced, and gasketed as required for an air tight installation. Insulation shall be finished up to the control box in such a manner as not to compromise service access to heater and provide a proper vapor seal at the edge of the insulation.

3.3 CONTROL COORDINATION

A. Coordinate and provide all items necessary for each heater to operate in accord with the control system sequences and methodology described in other sections of this division.

3.4 TEST AND BALANCE

A. All heater performance shall be certified by test and balance procedures as specified in section covering testing and balancing.

3.5 CLEANING AND PROTECTION

A. Contractor shall protect the heaters from damage from the time of their receipt until final acceptance and shall thoroughly clean the complete heater (including interior of control box) of all dirt and construction debris prior to requesting final inspection. Control box, access door, elements, control and like items which become damaged during the course of construction shall be required to "as new" condition or shall be replaced with new material or equipment components.

3.6 WIRING DIAGRAMS

A. Provide complete wiring diagram furnished by the heating coil system manufacturer to the mechanical systems control manufacturer and the electrical contractor. This wiring diagram shall completely indicate in full detail all electrical and control wiring requirements, terminals, etc., necessary to allow the control manufacturer and electrical contractor to completely coordinate their respective wiring portions of the heating coil system installation.

END OF SECTION

SECTION 15810

FAN COIL UNITS: HORIZONTAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install factory packaged horizontal fan coil units of the types, sizes, and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions; dimensions, weights, fan performance; airside pressure losses, waterside pressure losses; water quantities; coil descriptions.

1.5 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Trane
2. Carrier
3. International
4. Bohn
5. York/JCI

1.6 CERTIFIED PERFORMANCE

A. Be rated in accord with ARI Standard 441.

PART 2 - PRODUCTS

2.1 GENERAL

A. Horizontal Draw-through Cabinet Type: With enclosed fan, return air plenum and filter section. Suitable for suspended exposed mounting.

2.2 FILTERS

A. Fan Coil Unit Filter Box: Integral part of fan coil unit assembly.

B. Filters: Refer to section entitled "Filter Assemblies".

2.3 CHILLED WATER COILS

A. Performance: Provide complete chilled water coil assemblies of size, capacity and characteristics indicated on the drawings. Coils shall be ARI certified.

B. Coordinative Requirements: Coils shall be an integral component of the unit assembly and shall be factory installed and coordinated to function with the unit as described.

C. Other Coil Requirements:

1. Aluminum fins mechanically bonded to copper and leak tested to be leak proof at a minimum pressure of 1.5 times maximum operating pressure.
2. Supply and return connections on same side of coils (unless otherwise specified).
3. Piped and installed in accordance with manufacturer's recommendations for the particular application on this project.
4. Drainable.
5. Have means of air venting.

2.4 CABINET CASING

A. 18 gauge or heavier galvanized steel with prime coat paint; designed for service access; insulated internally with fiberglass insulation; discharge duct collar and/or return air duct collar where indicated.

2.5 FAN ASSEMBLY

A. Statically and dynamically balanced at factory; forward curved, centrifugal, double inlet type.

2.6 MOTOR AND DRIVE

A. 3-speed motors with sleeve bearings. Direct drive.

2.7 DRAIN PAN

A. Insulated and extending under full length and width of cooling coil and valves.

PART 3 - EXECUTION

3.1 EQUIPMENT PLACEMENT

A. Equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.2 DUCT CONNECTIONS

A. Supply and return ducts shall be connected to their respective units with flexible connectors. Connectors shall be properly installed so that they are not in tension and are aligned with their respective ducts.

3.3 OTHER REQUIREMENTS

A. Properly connect all piping.

B. Allow adequate space for all service and operational clearances necessary.

END OF SECTION

SECTION 15850

AIR HANDLING UNITS, CENTRAL STATION, MODULAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install modular central station air handling units of the types, sizes, and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section "General Mechanical Provisions" for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the drawings and specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions; dimensions; weights; fan performance curves, airside pressure losses; waterside pressure losses; water quantities; coil descriptions; and unit inlet, discharge and radiated sound power levels, by octave bands, at the stated conditions; and a complete schedule worked up by unit number.

1.5 CERTIFICATION

A. Equipment performance ratings shall be certified as follows:

1. Fans: AMCA Bulletin 210 or ARI Standard 430.
2. Coils: ARI Standard 410.

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Trane
2. York
3. Carrier

PART 2 - PRODUCT

2.1 GENERAL

A. Units shall be configured of standard modules arranged in sequence in direction of air flow as required to meet project requirements. Modules shall generally include, but not be limited to, the following as applicable to each air handling unit's individual requirements:

1. Intake module.

2. Mixing/Filter-Mixing Box module.
3. Filter module(s).
4. Inspection and/or access module(s).
5. Coil module(s).
6. Fan module.
7. Discharge plenum module(s).

Modules shall comply with the requirements of the following component descriptions as appropriate to the configuration of the individual module.

B. Unit layout and configuration shall be as defined in project plans and schedule.

C. Provide unit mounting legs to support all sections of unit and raise unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit mounting device is not of sufficient height to properly trap unit. Unit mounting devices not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel.

2.2 MODULE CASINGS

A. Unit shall be constructed of a complete structural frame with removable panels. Unit manufacturer shall ship separate segments so unit can be broken down for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTMB 117 250-hour salt-spray test. The removal of side panels shall not affect the structural integrity of the unit. All removable panels shall be gasketed to minimize air leakage. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

B. Construct casing sections capable of operating from -4"wg to +6"wg.

C. Hinged access doors shall be available in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance. At a minimum, doors shall be provided in filter, upstream of cooling coil, downstream of cooling coil and fan sections. Removable access panels in lieu of doors are not acceptable.

D. Access doors shall be double wall construction to prevent damage to insulation during routine maintenance.

E. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of all interior surfaces.

F. Door hardware shall be surface mounted to minimize penetrations in the door casing that could lead to air leakage paths.

G. All joints between exterior panels and structural frames, as well as joints between module frames, shall be properly sealed and gasketed to provide an air seal.

H. Panels shall be double-wall construction to facilitate cleaning of the unit interior. The interior wall shall be constructed of solid, galvanized steel. Thermal resistance (R-value) shall be 8.33 ft2-hr-F/BTU or better.

2.3 FANS

A. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at

the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.

B. Provide grease lubricated ball bearings selected for L-50 200,000-hour average life per ANSI/AFBMA 9. Greasable bearings shall have lubrication lines extended to the drive side of the unit. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. Extend both grease lubrication lines to drive side of unit and rigidly attach to drive side bearing support with zerk fittings. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.

C. Fans shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Flexible canvas ducts shall be installed between fan and unit casing to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A and UL 181 requirements.

D. Fan modules shall have a access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.03 paragraphs D, E, and F.

E. Fans for VAV applications shall be factory inverter duty balanced prior to shipment.

2.4 MOTORS AND DRIVES

A. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.

B. Fan Motors shall be heavy duty, open drip-proof, E+.

C. Motors shall be selected to operate continuously at 104 F (40 C) ambient without tripping of overloads. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation. Motors shall be in compliance with EPACT when applicable.

D. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate.

E. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:

1. Fan and motor sheave part number
2. Fan and motor bushing part number
3. Number of belts and belt part numbers
4. Fan design RPM and motor HP
5. Belt tension and deflection
6. Center distance between shafts

2.5 COILS

A. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drainpan under the coil.

B. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

C. Construct coil casings of stainless steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

D. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

E. On stacked cooling coils, intermediate stainless steel drain pans shall be installed between the coils. Intermediate drain pans shall have drop tubes to guide condensate to the main drain pan, thus preventing flooding of lower coils that would result in moisture carryover.

F. Where indicated on the schedule coils shall be provided with a factory applied heresite corrosion protection coating. Manufacture shall guarantee no moisture carryover when coating is applied. Field applied coating is unacceptable.

G. Hydronic Coils:

1. Supply and return header connections shall be clearly labeled on outside of units such that direction of coil water-flow is counter to direction of unit air-flow.
2. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
3. Headers shall be constructed of round copper pipe or cast iron.
4. Tubes shall be 1/2 inch O.D. or 5/8” O.D minimum .016 inch thick copper. Fins shall be aluminum.

2.6 BASE-LEVEL DRAIN PANS

A. Insulation shall be encased between exterior and interior walls. Units with cooling coils shall have stainless steel drain pans under complete cooling coil section that extend beyond the air-leaving side of the coil to ensure capture of all condensate in section. Cooling coil drain pans shall be sloped in 2 planes, pitched toward drain connections to ensure complete condensate drainage when unit is installed level and trapped per manufacturer's requirements. See section 2.05, paragraph E for specifications on intermediate drain pans between cooling coils.

B. Units with heating coils shall have a galvanized steel drain pan under complete heating coil section sloped in 2 planes and pitched toward drain connections to ensure proper drainage during cleaning and to capture water in the event of a coil failure.

C. All drain pan connections supplied by unit manufacturer including, piping, and piping connections extending from stainless steel drain pans shall be constructed of stainless steel. The contractor is responsible to ensure the unit is installed level, trapped in

accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

2.7 FILTERS

A. Provide factory-fabricated filter section(s) of the same construction and finish as unit casings. Filter section(s) shall have filter guides and access door extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.03, paragraphs D, E, and F. Provide filter blockoffs as required to prevent air bypass around filters.

B. Pre-Filters:

Thickness:	2-inches
Efficiency:	MERV 8
Media Type:	Pleated media
Access:	Removable from one side of unit
Arrangement:	Provided as defined by drawings.

C. Final Filters:

Thickness:	4-inches
Efficiency:	MERV 11
Media Type:	Pleated media
Access:	Removable from one side of unit
Arrangement:	Provided as defined by the drawings.

2.8 DAMPERS

A. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as scheduled. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 5 CFM/square foot at one inch water gauge and 9 CFM/square foot at 4 inches water gauge. All leakage testing and pressure ratings shall be based on AMCA Publication 500. Manufacturer shall submit brand and model of damper(s) being furnished.

B. Where required, provide a factory-mounted ASHRAE Standard 62 airflow monitoring and control station in the outdoor air opening of the mixing box. The monitor shall track a variable outside air quantity for ventilation demand flow control and ventilation flow documentation. The airflow monitoring station shall be factory-mounted, factory-calibrated, and installed per the airflow monitor manufacturer's recommendations.

1. The air handling unit mixing box shall also include a modulating outside air damper mounted in series with the air flow monitor.
2. All linkages, crank arms, jack shafts and mounting hardware shall be provided.
3. The airflow monitoring station shall be calibrated to measure a variable airflow from 15% of nominal airhandler cfm up to 100% of design airflow, maintaining an accuracy of plus or minus five (5%) percent of actual cfm, for air measuring between -40F up to +158F. Monitoring station shall compensate for outside air temperature fluctuations that affect mass flow rate of air.
4. Manufacturer shall submit test data to demonstrate compliance.
5. The airflow monitoring station shall provide a proportional output velocity signal (2-10 vdc). The velocity sensor shall have an automatic zeroing function and shall be programmed to recalibrate the device's transducer a minimum of once per day to ensure continuous accuracy of airflow measurements. The monitor manufacturer shall provide to the Building Automation System (BAS) contractor a certified conversion table for the signal provided.

2.9 ACCESS SECTIONS

A. Access for inspection and cleaning of the unit drain pan, coils and fans sections shall be provided. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be included in the maintenance manual. Access section shall have double wall, hinged, removable access doors on one side of sections. Construct doors per Section 2.03 paragraphs D, E, and F.

2.10 OVERALL CONSTRUCTION

A. Shall be low, medium or high pressure as recommended by the manufacturer for operation at the indicated conditions.

2.11 UNIT COMPONENTS AND CONFIGURATIONS

A. General: Refer to drawings and schedules for components and configurations of units. In general and unless exceptions are indicated, unit assemblies shall consist of the following items in series in direction of air flow:

B. Draw-through Type Units:

1. Mixing box / filter module.
2. Coil module(s).
3. Fan module.

2.12 CONSTRUCTION PRESSURE REQUIREMENTS

A. Each unit shall be specifically cataloged, rated and constructed for operation at the total static pressure conditions of the system in which the unit is utilized and shall be recommended by the manufacturer for the specific pressure and operating conditions encountered on this project.

2.13 OTHER REQUIREMENTS

A. Units shall be horizontal or vertical configuration (as applicable).

B. Cooling coils shall not have face velocities in excess of 550 fpm unless otherwise indicated on drawing schedule (in such case, velocity obtained from drawing schedule shall be upper limit).

C. Units shall be provided which will perform as indicated with proper consideration of any correction factors which are applicable to unit casing configuration.

D. Heating coils shall be located in either or both the reheat and preheat positions as scheduled.

E. Pipe all coils for counterflow heat transfer.

PART 3 - INSTALLATION

3.1 EQUIPMENT PLACEMENT

A. Air handling equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.2 WIRING

A. Where units utilize internal drives, conduit penetrations shall be provided by the manufacturer. The conduit openings shall be located on the drive side and positioned so as not to compromise access to any portion of the unit. The opening shall be provided with effective seals and the edges of the internal insulation shall be properly sealed.

3.3 SOUND AND VIBRATION CONTROL

A. Refer to other sections for airside sound control and vibration control. Mount isolators using height saving brackets where required to reduce operating height of unit to suit space available.

3.4 DUCT CONNECTIONS

A. Supply and return ducts shall be connected to their respective air handler using flexible connectors. Connectors shall be properly installed so that they are not in tension and are aligned with their respective ducts.

3.5 PIPING

A. Refer to sections describing connected piping. Plug unused drain connections.

END OF SECTION

SECTION 15852

AIR HANDLING UNITS, SPLIT SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install medium duty factory packaged air handling units with direct expansion refrigerant coils of the types, sizes, and capacities indicated.

1.2 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions, dimensions; weights; fan performance curves, airside pressure losses; waterside pressure losses; coil descriptions; and fan discharge and radiated sound power levels, by octave bands, at the stated conditions.

1.3 CERTIFICATION

A. Equipment performance ratings shall be certified as follows:

1. Fans: AMCA Bulletin 210 or ARI Standard 430.
2. Coils: ARI Standard 210-79.

1.4 MANUFACTURER

A. Basis of design: As scheduled on the drawings.

B. Acceptable: Carrier, Trane, York, Weatherking, Rheem.

1.5 COMPATIBILITY

A. Each unit must be compatible with the condensing units(s) to which it is matched. This includes unit arrangement/configuration, capacity, associated controls, piping and all other connected equipment to which the unit and its components are interfaced.

PART 2 - PRODUCTS

2.1 CASING

A. Unit casings shall be fabricated of mill galvanized steel reinforced with formed "hat" channels or steel angle iron frames and bracing to provide a rigid assembly. Casing shall be provided with removable panels for access to and removal of coils, dampers and fans in external units. Provide hinged access door for access to and removal of fans and drives in internal drive units.

2.2 DRAIN PAN

A. Unit drain pan shall be of the double wall internally insulated type with welded seams. Drain pan in draw-thru units shall extend under both the fan and coils sections and in blow-thru units under the entire coil and plenum section.

2.3 DIRECT EXPANSION REFRIGERANT COOLING COILS

A. Provide direct expansion refrigerant cooling coil of copper tubes with aluminum fins mechanically bonded thereto, circuited to provide proper refrigerant velocities, properly

matched with compressor-condenser assembly for proper operation, with expansion valves selected for optimum refrigerant flow from 20% to 100% full load.

2.4 ELECTRIC HEATING COILS

A. Where electric heating coils are shown or scheduled to be integral with the air handling unit, each such coil shall be as follows:

1. Factory assembled and prewired. Heater capacities, sizes and operating characteristics shall be as scheduled on drawings or as indicated in other sections.
2. Meet all applicable requirements of the current NEC.
3. UL listed including all built-in components.
4. Coordinated with the specified requirements of the mechanical system control system.
5. Provided in capacity control steps indicated or scheduled. If not otherwise indicated, heaters over 10 KW shall have heating elements sequenced on and off in 5 KW increments, and shall be wired for 2 stage operation. All heaters shall be equipped with both thermal and current overload devices, and the required heating and cooling system controls.

2.5 FANS

A. Fans shall be individually selected to best suit the air quantities and pressures scheduled. Fans handling less than eighteen thousand (18,000) cubic feet per minute, at four and one-half (4-1/2) inches or less static pressure may be of the forward curved blade centrifugal type. Fans handling eighteen thousand (18,000) cubic feet per minute or more or operating at more than four and one-half (4-1/2) inches static pressure shall be of the backward inclined airfoil blade centrifugal type. All fans shall be double width, double inlet type. Fans and shafts shall be selected to operate not less than twenty-five percent (25%) below their first critical speed, statically and dynamically balanced, and keyed to the shafts. Shafts shall be of the hollow large diameter type with tapered and strengthened ends where they extend entirely through the casing and shall be solid steel for fans having drives within the casing. Shafts shall be turned and shall be ground and polished at bearing and fan mounting points.

2.6 BEARINGS

A. Provide regreaseable ball types selected for an average life of 200,000 hours at design operating conditions. Bearings shall have grease line extended to the drive side of the fan casing of the drive side of the fan scroll for internal drive fans.

2.7 DRIVES AND MOTORS

A. Provide guards for internal and external drive fans.

2.8 INSULATION

A. The entire air handling unit casing (including accessory sections), including structural frame and channels shall be insulated from contact with the air stream. Insulate using one inch (1") thick, three (3) pound per cubic foot density fiberglass duct liner having a neoprene stabilized face toward the air stream. The insulation shall be secured using a full coverage insulation and adhesives shall comply with the requirements of NFPA 90A as to flame spread and smoke developed ratings.

2.9 FILTERS

A. See section describing air filters.

2.10 OVERALL CONSTRUCTION

A. Shall be as recommended by the manufacturer for operation at the indicated conditions.

2.11 OTHER REQUIREMENTS

A. Be horizontal or vertical configuration (as applicable).

B. Cooling coils shall not have face velocities in excess of 500 fpm unless otherwise indicated on drawings schedule (in such case, velocity obtained from drawings schedule shall be upper limit).

C. Units shall be provided which will perform as indicated with proper consideration of any correction factors which are applicable to system unit casing configuration.

D. Heating coils, if required, shall be located in reheat position unless otherwise indicated.

PART 3 - INSTALLATION

3.1 EQUIPMENT PLACEMENT

A. Air handling equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.2 WIRING

A. Where units utilize internal drives, conduit penetrations shall be provided by the manufacturer. The conduit openings shall be located on the drive side and positioned so as not to compromise access to any portion of the unit. The opening shall be provided with effective seals and the edges of the internal insulation shall be properly sealed.

3.3 SOUND AND VIBRATION CONTROL

A. Refer to other sections for airside sound control and vibration control. Mount isolators using height saving brackets where required to reduce operating height of unit to suit space available.

3.4 DUCT CONNECTIONS

A. Supply and return ducts and combination filter mixing boxes shall be connected to their respective air handler using flexible connectors. Connectors shall be properly installed so that they are not in tension and are aligned with their respective ducts.

3.5 HOUSEKEEPING PAD

A. Provide 6 inch high reinforced concrete (with 10 x 10 WWP) housekeeping pad for each floor mounted unit. The housekeeping pad shall extend 6 inches beyond the unit base in all directions and shall be continuous beneath the base. Pads shall have chamfered edges and shall be poured and finished smooth and level.

3.6 OTHER REQUIREMENTS

A. Properly connect all piping.

B. Allow adequate space for all service and operational clearances necessary.

END OF SECTION

SECTION 15863

FANS: IN-LINE CENTRIFUGAL, LIGHT DUTY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide in-line centrifugal light duty exhaust fans of size, sound power level, and electrical characteristics indicated on drawings.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on: fan external static pressure, fan rpm, motor rpm, fan tip speed, fan size, fan performance tables or curves showing all possible operating selection points for each fan size (including rating certification), fan brake horsepower, motor horsepower and electrical characteristics sound level, fan accessories, and a complete schedule worked up by fan number.

B. Exhaust air fans shall be AMCA certified as to both sound and performance ratings.

1.5 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Acme Engineering and Manufacturing Company
2. Greenheck Fan and Ventilator Corp.
3. Ilg Industries, Inc.
4. Powerline, Inc.
5. Penn Ventilator Company
6. Loren Cook Company
7. Jenn Air
8. Carnes
9. Captive Aire

PART 2 - PRODUCTS

2.1 FAN HOUSING

A. Fan housing including longitudinal, traverse, and diagonal stiffeners, motor mounts, bearing and drive supports shall be constructed of steel. Entire fan housing shall be internally lined with 1/2-inch or greater, three pound per cubic foot density fiberglass

acoustical duct liner with a stabilized surface. Liner shall be held in place with adhesive and mechanical fasteners. All insulation and adhesives shall meet requirements of NFPA 90A as to flame spread and smoke developed ratings. Housing, including all bracing, stiffeners and motor mounting assembly shall be factory finished with a baked on alkyd enamel finish over a corrosion resistant primer. Removable panel in bottom of housing for complete access to motor and fan. Inlet and outlet duct connections.

2.2 FAN WHEEL

A. Shall be centrifugal type and shall be statically and dynamically balanced.

2.3 FAN MOTOR

A. Permanently lubricated shaded pole motor mounted on resilient isolators to minimize vibration and noise.

2.4 BACKDRAFT DAMPER

A. Mounted in throat of fan discharge.

2.5 DRIVE ASSEMBLY

A. Drive shall be direct drive type as indicated on drawings, and shall conform with the requirements of Section entitled "General Mechanical Provisions".

2.6 DISCONNECT SWITCH

A. Fans shall include factory mounted disconnect switches prewired to the drive motor.

2.7 SPEED CONTROL

A. Solid state speed controller for speed reduction to 40%. Mounted on housing or as otherwise indicated.

PART 3 - EXECUTION

3.1 FAN PLACEMENT AND MOUNTING

A. Fan locations shall be essentially as shown on drawings; however, actual wall openings and fan placement shall be verified using field measurements and data relating to equipment approved for actual installation on this project. Mount fan in strict accordance with manufacturer's instructions.

3.2 SOUND AND VIBRATION CONTROL

A. Refer to Section entitled "Ductwork" for air side sound control and to Section entitled "Vibration Isolation" for vibration control.

3.3 DUCT CONNECTIONS

A. Inlet and discharge ducts shall be connected to the fan duct collars using flexible connectors. These connectors shall be installed properly so that they are not in tension and are aligned with their respective ducts.

3.4 TEST AND BALANCE

A. All fan performance shall be certified as specified in section describing test and balance procedures.

3.5 OTHER REQUIREMENTS

A. Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.

B. Provide necessary anchorage and supports to prevent vibration.

END OF SECTION

SECTION 15890

DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide complete duct systems as indicated. Systems shall include, but not be limited to, the following: outside air, exhaust air, and air conditioning supply and return air duct systems as shown on drawings. Drawing scales prohibit the indication of all offsets, fittings, and like items; however, these items shall be installed as required for the actual project conditions at no change in contract price.

B. Items Included: This section generally includes, but is not limited to, the following major items:

1. Low pressure sheet metal ductwork.
2. High pressure sheet metal ductwork, round and flat oval.
3. High pressure sheet metal ductwork, rectangular.
4. Low pressure flexible ducts.
5. High pressure flexible ducts.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 15 and to other applicable portions of the Drawings and Specifications.

B. This section is directly related in particular to sections (which may or may not be included in this division) which describe the following:

1. Sections describing air handling equipment and fans.
2. Air distribution devices.
3. Terminal units.
4. Duct system accessories.
5. Insulation.

C. Coordinate shop drawings, ordering, delivery, and placement of all items affecting the duct systems including, but not limited to, the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels, air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs, structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work. Refer to the requirements of Section entitled "General Mechanical Provisions".

D. Refer to other sections which may describe additional sound attenuation measures which may relate to this section.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include complete data as applicable to this project on: all prefabricated duct and fittings; duct liner including

mechanical fasteners and adhesives; duct sealing materials; duct joining and seaming methods; and all other items. If required by Architect, prepare and submit for approval completely detailed shop drawings of supply and return ductwork from any or each air handling unit through its transitions, bends and elbows until such ducts are extended beyond the air handling unit equipment area and/or congested areas; these shop drawings will not be required unless specifically called for elsewhere or unless significant deviation from the Drawings is necessitated by the equipment provided.

1.5 OTHER REQUIREMENTS

A. Provide all ductwork and components thereof in accord with manufacturer's recommendations. All ductwork dimensions indicated are nominal free clearance internal dimensions which do not include insulation thickness.

1.6 DEFINITIONS

A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc."

B. Low Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities less than 2500 fpm and static pressure less than 2.0 inches wg. This ductwork may also be referred to in these specifications as "Low Velocity Ductwork". SMACNA "HVAC Duct Construction Standards, Metal and Flexible", Second Edition, 1995, shall govern construction of this ductwork unless otherwise specified.

1. Where and if fiberglass ductwork is specified, it shall be considered only for low pressure classification use and shall be constructed in accord with SMACNA "Fiberous Glass Duct Construction Standards", Fifth Edition, 1977.

C. High Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities equal to or greater than 2500 fpm or static pressure equal to or greater than 2.0 inches wg. This ductwork may also be referred to in these specifications as "High Velocity Ductwork" or "Medium Pressure Ductwork", but shall be considered, in either terminology, to fall within pressure/velocity class (PV/C designation) 3 to 10. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", Second Edition, 1995, shall govern construction of this ductwork unless otherwise specified.

1.7 PRESSURE/VELOCITY CLASSIFICATIONS

A. Pressure and velocity classifications (hereinafter called "P/VC") for ducts are defined as follows:

P/VC Desig.	SMACNA Pressure Class	Static Pressure Rating	Positive or Negative Pressure	SMACNA Seal Class	Maximum Velocity (fpm)
10	High	10"	+	A	2000 up
6	Medium	6"	+	A	2000 up
4	Medium	4"	+	A	4000 dn
3	Medium	3"	+ or -	B	4000 dn
2	Low	2"	+ or -	C	2500 dn
1	Low	1"	+ or -	C	2500 dn
½	Low	1/2"	+ or -	C	2000 dn

B. See Part 3, EXECUTION, of this section for duct sealing requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall comply with current SMACNA standards.

B. ASTM: Unless otherwise specified, ASTM material specifications applicable are:

Material	Type	ASTM Number
Galvanized steel	G90	A525
Stainless steel	304,316	A240
Cold rolled steel	20-28 ga.	A366
Cold rolled steel	18 ga.	A619
Aluminum	3003 H-14	B609

C. Special Materials, Gauges and Construction:

1. Special Materials: Where special duct material other than galvanized steel is required, such duct material (e.g., fiberglass, stainless steel, plastic such as polyvinylchloride, etc.) shall be specifically indicated.
2. Gauges: Gauges indicated in this section are for galvanized steel. Where greater or lesser gauges are specifically indicated for a sheet metal material other than galvanized steel, provide the indicated gauge. Comply with the SMACNA construction standard covering the required material if no gauge is given.
3. Construction: Comply with indicated special requirements (i.e., such as welding, soldering, etc.) where application requires.

2.2 LOW PRESSURE SHEET METAL DUCTWORK

A. Material: Prime quality forty-eight inch wide resquare tight coat galvanized steel conforming to the requirements of ASTM A-525 and/or A-527 as applicable to the intended use.

B. Construction:

1. Construct to comply with the pressure/velocity classification(s) indicated.
2. Use rectangular or round as indicated on drawings.
3. Reinforcing, Cross Breaking, Seams, Joints: Be in accord with latest SMACNA construction standard for low pressure sheet metal duct.
4. Gauge: As required by SMACNA for the dimensions and pressure/velocity classification involved.

C. Insulation:

1. Rectangular rigid sheet metal ductwork: shall be internally lined with acoustical thermal duct liner if so designated.
2. Round rigid sheet metal ductwork: Where low pressure round ductwork is designated to have internal acoustical/thermal liner, provide factory fabricated double wall ductwork as specified for high pressure round acoustically lined sound attenuating duct (i.e., factory fabricated double wall duct with perforated inner wall).

2.3 HIGH PRESSURE DUCTWORK, ROUND AND FLAT-OVAL

A. General:

1. Comply with current SMACNA standards.
2. Factory fabricated portions shall be made by United McGill, Semco or equal.

B. Straight Conduit: Galvanized steel unless otherwise indicated for a specific application.

1. Seam construction: Spiral lock-seam (SMACNA Type RL-1) allowed for all pressure/velocity classifications. Longitudinal grooved seam (SMACNA Type RL-5) allowed only up to pressure/velocity classification P/VC-3.

C. Fittings:

1. Material: Same as connecting duct system.
2. Configuration: Standard design as manufactured by United McGill, Semco or equal.
3. Elbows:

   a. General: All mitered elbows must be vaned.
   b. Round: 5-inch diameter and larger shall be five-section construction; less than 5-inches diameter shall be die-formed.
   c. Flat-oval: Five-section construction.
   d. Hard turn oval elbows shall have vanes as follows:

Equivalent diameters	Number of Vanes
10" through 14"	3
15" through 19"	4
20" through 60"	5
Over 60"	12" spacing

4. Vanes: Be minimum 20 gauge and limited to 24 inches of unsupported length. The leading edge of all vanes in duct exceeding 20 inch size will be hemmed with a 1/2 inch fold back.
5. Divided Flow Fittings: All divided flow configurations are to be furnished as separate fittings. Tap covers welded into spiral duct sections are not acceptable. All tees, crosses and laterals up to an including 12" diameter tap size, will have a minimum 3/8" radius rounded entrance into the tap, produced by machining, press forming, or hand grinding to a smooth entrance. The entrance will be free of projections, weld buildups, burrs or irregularities. All fittings will have continuous welds along all seams.
6. Tees and Crosses: All tees and crosses shall be the spun conical type with branch entrances through 12" size, to be rounded laminar flow as noted above.
7. Connections: Connections of conduit to fittings shall be made with a synthetic rubber sealing compound conforming to NFPA 90A as to flame spread and smoke developed ratings and mechanically fastened with drive or twist screws, and all joints tested in accordance with test procedure described hereinafter. Raychem TDB duct sealing bands may be used in lieu of the sealing compound. Connection between conduit and terminals shall be made with a maximum of 48" of flexible duct. Runout connections shall be assembled in same manner as conduit and fittings.

D. Gauge: Minimum gauge as follows (gauges are for round and flat-oval duct with spiral lock-seam construction unless otherwise indicated):

1. Round duct (galvanized steel):

Diameter (Inches)	Gauge	Alternate Gauge(2)
3 thru 8	26	24
9 thru 14	26	24
15 thru 26	24	22
27 thru 36	22	20
37 thru 50	20	20
51 thru 60	18	18
61 thru 84	18(1)	16

(1) Must be 16 ga. when static pressure is negative.
(2) Alternate gauges are allowable for longitudinal grooved seam (SMACNA Seam Type RL-1) and only for pressure/velocity class up to P/VC-3.

2. Flat-oval duct (galvanized steel):

Major Dimension (Inches)	Gauge
0 thru 24	24
25 thru 36	22
37 thru 48	22
49 thru 60	20
61 thru 70	20
71 and up	18

E. Fittings:

1. Round duct: Same as duct unless otherwise recommended by manufacturer.
2. Flat-oval duct:

Major Dimension (Inches)	Gauge
0 to 24	20
25 to 36	20
36 to 48	18
49 to 60	18
61 to 70	16
71 and up	16

F. Acoustically Lined Sound Attenuating Round and Flat Oval Duct and Fittings: General construction is specified in paragraphs above. Flame spread and smoke developed ratings shall comply with NFPA 90A. Double walled with zinc coated solid sheet steel outer wall and zinc coated perforated sheet steel inner wall. One inch thick annular space between inner and outer walls uniformly packed with fiberglass insulation with effective thermal conductivity of 0.27 BTUH per sq. ft. (F^o per inch) separated from air stream using mylar film. Equal to United Acousti-K27.

2.4 HIGH PRESSURE DUCTWORK, RECTANGULAR

A. General:

1. Airtight and structurally stable at maximum system operating pressure.
2. Any welding shall be continuous and corrosion resistant.
3. Galvanized sheet steel unless otherwise indicated for a specific application.
4. Reinforced and supported to neither cause nor convey any objectionable vibrations.
5. Be in accordance with latest SMACNA construction standard for high pressure ductwork.

B. Turning Vanes: Adequate rigidity and strength to be completely flutterproof. Airfoil, permanently fixed type constructed of galvanized steel of aluminum with sound attenuating fiberglass inner liner with open protective metal facing. Quantity in each elbow in accordance with manufacturer's recommendations. Airsan Acoustiturn as made by Air Filter Corporation, 4554 W. Woolworth Ave., Milwaukee, Wisconsin 53218 or equal.

2.5 HIGH PRESSURE DUCT RELIEF AND ACCESS DOORS

A. Provide suitable size for access to heaters, dampers and other equipment installed in duct, and at other points indicated on drawings. Size shall be as listed by paragraph above and compatible with duct size but not smaller than 8"x12". Doors shall be 24 US gauge galvanized steel hinged to a 24 gauge galvanized mounting frame and for insulated duct shall be double panel construction with 1/2 inch rigid insulation material between metal panels. Doors shall be United Sheet Metal Type AR or an approved equal.

2.6 LOW PRESSURE FLEXIBLE DUCTS

A. General:

1. The inclusion of flexible ducts in this specification shall not be construed as approval of use on the project unless specifically shown on the Drawings.
2. Where used, provide in factory finished lengths not in excess of lengths required to make kink-free connections with minimum air pressure drop.

B. Insulated flexible ducts: Flexible duct shall be factory-fabricated preinsulated type with seamless vapor barrier. Duct shall bear UL 181 Class 1 Air Duct label and shall comply with NFPA 90A and 90B. Fiberglass insulation nominal 1" thickness with thermal conductance of 0.23 BTU/hr-ft2-^{o}F maximum at 75^{o}F mean temperature. Flexible duct shall have an operating range of minus 0.5" w.g. to plus 2" w.g. Core shall be continuous and consist of aluminized mylar laminated to corrosion resistant steel wire helix. Vapor barrier perm rating shall be 0.17 maximum per ASTM E96-A. Maximum working velocity shall be 4000 FPM. Flexible duct shall be Genflex SLR-25, Clevaflex Type KQ, Wire Mold type WG, Flexmaster Type 5B or approved equal.

C. Un-insulated flexible ducts, steel: Flexible ductwork shall be constructed of all metal one ply hot-dipped galvanized steel, closely corrugated for strength and flexibility, with seams interlocked, folded flat, and knurled to insure tightness. Duct shall be listed as #UL181 "Flexible Air Duct", Class 1, and NFPA 90A. Products shall be Flexmaster Type NI-TL, Clevaform Type GS or approved equal.

D. Round branch take-off fittings for flexible duct:

1. Round duct branch take-off fitting shall be made of galvanized sheet metal designed for twist-in installation and to assure minimum air loss at the take-off. The fittings shall be of the conical converging type to reduce the pressure drop through the fittings. Provide a raised bead on the throat of the fitting to assure a tight positive connection. Products shall be Flexmaster Model CB-DE-BO3 or approved equal.
2. Provide each fitting with the following:

   a. Lockable quadrant damper.
   b. 45-degree extractor scoop.
   c. Insulation guard where used with internally lined ductwork.

3. Provide these "spin-in" type fittings at all connections between rigid sheet metal duct and flexible duct at the upstream end of the flexible duct.

2.7 HIGH PRESSURE FLEXIBLE DUCTS

A. Meet all requirements for low pressure flexible ducts except be recommended by manufacturer for high pressure application.

PART 3 - EXECUTION

3.1 GENERAL

A. All duct systems shall be free of noise, chatter, vibration and pulsation under all conditions of operation. Remove, replace or reinforce as directed by the Architect/Engineer if necessary to correct such conditions.

B. If field conditions are determined to exist which would limit the guarantee of air delivery or system performance, due notice in writing shall be submitted to the Architect/Engineer of such conditions prior to starting fabrication.

C. Properly support and align ductwork. Ducts to be free of sag and bulge. Hang ductwork below concrete floors or roof deck with hangers set prior to pouring concrete, or from self drilling screw anchors. GUN POWDER SET ANCHORS ARE NOT PERMITTED.

D. Where it is necessary that ducts be divided due to pipes or other obstructions which must pass through these ducts, the Contractor shall, at locations as noted or directed, provide air-stream deflectors in the duct and the duct shall be increased in size to maintain equivalent area around deflectors. Such changes shall be in accord with standard SMACNA details and shall be shown on Contractor's As-Built Drawings.

E. Interior of ductwork visible through registers, grilles, or diffusers shall be painted flat black.

F. Do not route ductwork through transformer vaults and electrical equipment spaces and enclosures.

G. Construct all ductwork and accessories in accord with the latest indicated editions of applicable SMACNA construction standards. Sheet Metal and Air Conditioning Contractors' National Association.

H. Streamline all ductwork to the full extent practical and equip with proper and adequate devices to assure proper balance and quiet draftless distribution of indicated air quantities.

I. Protect all ductwork and system accessories from damage during construction until Architect/Engineer's final acceptance of project.

J. Prior to ductwork fabrication, verify if all ductwork as dimensioned and generally shown will satisfactorily fit allocated spaces. Take precautions to avoid space interferences with beams, columns, joists, pipes, lights, conduit, other ducts, equipment, etc. Notify Architect/Engineer if any spatial conflicts exist, and then obtain Architect/Engineer's approval of necessary routing. Make any such necessary revisions which are minor at no additional cost.

K. Carefully correlate all duct connections to air handling units and fans to provide proper connections, elbows and bends which minimize noise and pressure drop.

L. Provide all curved elbows with radius ratios of not less than 1.5 unless otherwise shown or approved by Architect/Engineer. Provide all mitered elbows with turning vanes.

M. Properly suspend all ductwork so that no objectionable conditions result (such as vibration, sagging, etc.).

N. Coordinate any and all dimensions at interfaces of dissimilar type of ductwork and at interfaces of ductwork with equipment so that proper overlaps, interfaces, etc., of insulation and continuity of vapor barriers are maintained.

O. If necessary where ducts interface and have different types of insulation, provide transitions so that internal free-clear dimensions of duct remain unchanged.

P. Install horizontal low pressure ductwork at a level which maximizes length of any vertical, rectangular or round rigid duct connections to rectangular diffuser necks; however, such vertical duct connections are not required to be over 24 inches in length.

Q. Make connections from any low pressure ductwork to terminal units (fan terminal units, variable volume boxes, etc.) with appropriate lengths of flexible duct unless other type of connection is indicated.

R. Install all flexible round duct without kinks or similar obstructions so that pressure drop is minimized. Cut and remove excess lengths as necessary.

S. Install horizontal rigid ductwork as high as practical above suspended ceilings so that movable light fixtures may be relocated without interference to meet any future partition relocation requirements.

T. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.

3.2 LOW PRESSURE SHEET METAL DUCTS

A. If width or height of rectangular duct exceeds 12 inches, cross break or roll a cross bead in panels to increase stiffness; otherwise, use two gages heavier steel.

B. Provide corner closures. Longitudinal seams and transverse joints shall be flat and smooth inside. Make slip joints in direction of air flow. See governing SMACNA manual for transition requirements.

C. Fabricate offsets, turns and elbows with centerline radius equal to 1-1/2 times diameter when possible. No mitered offsets will be allowed. Provide double thickness turning vanes to assist in smooth flow of air in square elbows or elbows with centerline radius less than duct width or diameter.

3.3 HIGH PRESSURE DUCTWORK

A. In addition to other requirements, this ductwork shall be as follows:

1. Any welds shall be continuous and corrosion resistant.
2. Reinforced and supported to cause and/or to convey no objectionable vibrations.
3. All seams and joints permanently sealed and joined in strict accordance with the manufacturer's recommendations.

B. Conical Tees: Make all branch duct take-offs and all connections to flexible duct supplying air to terminal units with conical tees.

3.4 LOW PRESSURE FLEXIBLE DUCTS

A. Flexible ducts shall not be used unless specifically indicated on drawings.

B. If flexible duct is indicated for use on this project, it must comply with the following requirements.

1. The extent of the use of flexible ductwork shall be limited to that shown on the drawings.

2. Flexible duct installation shall be per SMACNA Flexible Duct Installation Standards, and manufacturers latest printed instructions, whichever is stricter. In addition the following shall apply:

    a. Flexible duct between rigid duct and diffusers shall be a MAXIMUM of 8 feet in length and shall be fully extended with a maximum equivalent of (2) 90 degree bends (no bend shall be made with centerline radius of less than one duct diameter). No additional flexible duct shall be provided for future terminal device relocation unless otherwise specified.
    b. Flexible duct shall be supported at ends and at each 90 degree bend. Maximum permissible sag is 1/2 inch per foot of spacing between supports.
    c. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1 inch wide. Narrower hanger material may be used in conjunction with a sheet metal saddle which meets the foregoing specifications. This saddle must be formed to cover one-half the circumference of the outside diameter of the flexible duct and must be rolled to fit neatly around the lower half of the duct's outer circumference.
    d. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when manufacturers recommended procedures are followed.
    e. Hangers shall be adequately attached to the building structure (not pipe, conduit, etc.).
    f. To prevent tearing of vapor barrier, do not support entire weight of flexible duct on any one hanger during installation. Avoid contact of flexible duct with sharp edges of hanger material. Damage to vapor barrier may be repaired with approved tape. If internal core is penetrated, replace flexible duct or treat as a connection.

3. Terminal devices connected by flexible duct shall be supported independently of the flexible duct.

3.5 HIGH PRESSURE FLEXIBLE DUCTS

A. Meet all the requirements for low pressure flexible ducts.

3.6 MISCELLANEOUS DUCT SYSTEM COMPONENTS

A. Spin-In Take-Off Fittings: Install around duct branch takeoff fittings according to manufacturer's installation instruction. Additionally seal fitting to rectangular duct with a thin bead of mastic sealant.

3.7 HANGERS AND SUPPORTS

A. General: Comply with latest applicable SMACNA construction standard. Where sprayed fireproofing occurs, install hangers before application of such treatment and withhold installation of ducts until after application.

B. Supports: Vertical risers and other duct runs where the method of support specified above is not applicable shall be supported by substantial angle brackets designed to meet field conditions and installed to allow for duct expansion.

C. Fasteners: Secure hangers to steel beams or metal deck with beam clamps or drop through connections from the metal or concrete deck.

3.8 CHANGES IN SHAPE OR DIMENSION

A. Where duct size or shape is changed to effect a change in area, the following shall apply:

1. Where the area at the end of the transformation results in an increase in area over that at the beginning, the slope of the transformation shall not exceed one inch in seven inches.
2. Where the area at the end of the transformation results in a decrease in area from that at the beginning, the slope of the transformation may be one inch in four inches, but one inch in seven inches is preferable, space permitting.
3. The angle of transformation at connections to heating coils or other equipment shall not exceed thirty degrees from a line parallel to the air flow on the entering side of the equipment, nor fifteen degrees on the leaving side. The angle of approach may be increased to suit limited space conditions when the transformation is provided with vanes approved by the Architect/Engineer.

3.9 CHANGES IN DIRECTION

A. Changes in direction shall be basically as indicated on the drawings and the following shall apply:

1. Supply duct turns of ninety degrees in low pressure duct shall be made with mitered elbows fitted with closely spaced turning vanes designed for maintaining a constant velocity through the elbow.
2. Return and exhaust duct turns of ninety degrees in low pressure duct shall be made with mitered elbows, as specified hereinbefore for supply ducts, unless radius elbows are indicated in which case they shall be constructed with a turning radius one and one-half (1-1/2) times the width (with width considered as the dimension in the plane of the turn) as measured to the duct centerline.
3. Tees in low pressure duct shall conform to the design requirements specified hereinbefore for elbows.
4. Branch take-offs in low pressure supply duct shall be made with extractors or splitter dampers, as indicated, in square take-offs.
5. In high pressure duct, branch take-offs and connections to flexible duct supplying air to terminal units shall be made with conical taps.

3.10 IMPROPER MATERIALS OR CONFIGURATION

A. If ductwork materials or ductwork configurations are installed which do not meet these specifications, Contractor shall remove such ductwork and replace with materials or configurations which are acceptable. Any delay in job progress will be the responsibility of the Contractor.

3.11 OTHER REQUIREMENTS

A. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.

B. Control Devices: Properly install all control related devices which are part of the duct systems. See Section(s) describing control systems.

3.12 SEALING OF DUCTS

A. Duct seal classes are as follows:

1. Seal class "A": Seal all transverse joints, longitudinal seams and duct wall penetrations. Use for P/VC-4 (4" w.g.) and greater unless otherwise indicated.
2. Seal class "B": Seal all transverse joints and longitudinal seams. Use for P/VC-3 (3" w.g.) unless otherwise indicated.

3. Seal class "C": Seal all transverse joints. Use for P/VC-2 (2" w.g.) and lower unless otherwise indicated.

B. Where sealing is required it shall mean the following:

1. The use of adhesives, gaskets, tape systems or combinations thereof to close openings in the surface of the ductwork and field-erected plenums and casings through which air leakage would occur; or
2. The use of continuous welds;
3. The prudent selection and application of sealing methods by fabricators and installers, giving due consideration to the designated pressure class, pressure mode (positive or negative), chemical compatibility of the closure system, potential movement of mating parts, workmanship, amount and type of handling; cleanliness of surfaces, product shelf life, curing time and manufacturer-identified exposure limitations;
4. That these provisions are applicable to duct connections to equipment and to apparatus but are not for equipment and apparatus;
5. That where distinctions between seams and joints are made herein, a seam is defined as joining of two longitudinally (in the direction of air-flow) oriented edges of duct surface material occurring between two joints. Helical (spiral) lock seams are exempt from sealant requirements. All other duct surface connections made on the perimeter are deemed to be joints. Joints are inclusive of but not limited to girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum and casing abutments to building structures; that sealing requirements herein do not contain provisions to:

    a. Resist chemical attack.
    b. Be dielectrically isolated.
    c. Be waterproof, weatherproof or ultraviolet ray resistant.
    d. Withstand temperatures higher than 120^{o}F or lower than 40^{o}F.
    e. Contain atomic radiation or serve in other safety-related construction.
    f. Be electrically grounded.
    g. Maintain leakage integrity at pressures in excess of the duct classification herein.
    h. Be underground below the water table.
    i. Be submerged in liquid.
    j. Withstand continuous vibration visible to the naked eye.
    k. Be totally leak-free within an encapsulating vapor barrier.
    l. Create closure in portions of the building structure used as ducts, e.g., ceiling plenums, shafts, pressurized compartments.

6. The requirements to seal apply to both positive pressure and negative pressure of operation.
7. Externally insulated ducts located outside of buildings shall be sealed prior to being insulated as though they were inside. If metal surfaces of ducts located on the exterior of buildings are exposed to weather, they shall receive exterior duct sealant. An exterior duct sealant is defined as a sealant that is marketed specifically as forming a positive air and water tight seal, bonding well to the metal involved, remaining flexible with metal movement and having a service temperature range of -30^{o}F to 175^{o}F. If exposed to direct sunlight it shall also be ultraviolet ray and ozone resistant or shall, after curing, be painted with a compatible coating that provides such resistance. The term sealant herein is not limited to materials of adhesive or mastic nature but is inclusive of tapes and combinations of open weave fabric strips and mastics.

C. Materials and applications for sealing ducts:

1. General:

a. Complete product data on all materials used for sealing ducts must be submitted for approval prior to any duct fabrication.
b. All sealants must be specifically recommended by their manufacturer for the purpose of sealing ducts.

2. Liquid Sealant:

a. Use only for slip type joints where sealant is to fill small space between overlapping pieces of metal. Do not use where metal clearances exceed 1/32-inch.
b. Sealant must be specifically manufactured for the purpose of sealing ducts.

3. Mastics:

a. Use in lieu of liquid sealant at Contractor's option.
b. Use as a fillet, in grooves and between flanges.
c. Do not use oil base caulking or glazing compounds.

4. Gaskets:

a. Use soft elastomer butyl or neoprene rubber or extruded forms of sealants in flanged joints in addition to mastic.

5. Tape:

a. Tape is not allowed on sheet metal ducts.

6. Combination of mastic and embedded fabric:

a. Use mastic/mesh/mastic as a sealant where pressure/velocity classification equals and exceeds P/VC-3 and where any spaces between metal surfaces at transverse joints or longitudinal seams or duct wall penetrations exceeds 1/16-inch.
b. Apply glove coat of mastic, then embed a continuous or overlapping strip of not less than 4-inch wide 10 x 10 fiberglass cloth into the mastic, then apply a final glove coat of mastic over the glass cloth.

7. Surface preparation:

a. Surfaces to receive sealant should be adequately clean (free from oil, dust, dirt, rust, moisture, ice crystals and other substances that inhibit or prevent bonding). Use solvent and/or apply a face primer if necessary to obtain adequately clean surface for adhesion.

3.13 LEAKAGE TESTING

A. General:

1. Test the following duct systems:

a. All ducts which are (1) under positive or negative pressure and (2) which are directly connected to air moving device (air handling unit, exhaust fan, supply fan or similar air moving equipment) and (3) which convey 1000-cfm or greater through their largest portion.
b. All ducts which are (1) under positive or negative pressure and (2) which are part of a supply, return, outside and/or exhaust air system and (3) which are equal to or greater than 25 feet in length and (4) which may or may not be directly connected to an air moving device.

2. Portions of duct to be tested shall consist of all portions from the largest cross sectional area to the air distribution device connection or to the smallest inlet or outlet point, whichever is applicable.
3. Duct systems shall be constructed so that leakage does not exceed 5.00% of the air quantity handled by the respective fan.

B. Allowable Leakage:

1. Leakage shall be measured during leakage test at a test pressure which is equal to the pressure/velocity classification of the duct system (e.g., a P/VC-2 duct shall be tested at 2.0 in. w.g.s.p., a P/VC-1/2 duct at 0.5 in. w.g.s.p., etc.).

C. Test Procedure:

1. Test at time of duct installation and prior to installation of any field applied insulation and prior to any concealment in chases or similar enclosures.
2. Duct openings (both entry openings and outlet openings) shall be capped or sealed by taping or banding a flexible plastic sheet over each opening prior to pressurizing duct. The plastic sheet shall be of adequate strength and thickness to withstand the test pressures. Use other method of sealing duct openings providing objective of test is obtained and if method of sealing is approved by Architect/Engineer.
3. Use a fan having a minimum capacity of 300-cfm or 5% of the particular duct system design capacity, whichever is greater and which is capable of producing a duct test pressure of 150% of the duct test pressure.
4. Test fan shall be connected to a flow measuring assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with appropriately located pressure taps. Orifice assembly shall be accurately calibrated with its own calibration curve. Pressures shall be measured with U-tube manometers and corresponding flow rates obtained from the orifice performance curve.
5. Connect test fan and orifice flow measuring assembly to the duct to be tested with a section of flexible duct.
6. Test for audible leaks as follows:

    a. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
    b. Start the blower with its control damper closed (some small blowers popularly used for testing ducts may damage the duct because they can develop pressures up to 25 inches (W.G.).
    c. Gradually open the inlet damper until the duct pressure reaches 50% in excess of designed duct operating pressure.
    d. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealing has been repaired if and where necessary.

7. After all audible leaks have been sealed, the leakage should be measured with the orifice section of the test apparatus as follows:

    a. Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.
    b. Total allowable leakage shall not exceed five (5) percent of the total system design air flow rate. When partial sections (such as supply section, return section, etc.) of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

8. Correct any duct leaks which are detected either audibly or by touch regardless of whether leakage through duct system is less than allowable test leakage.

3.14 DEFINITIONS OF DUCT TYPES

A. Refer to the construction schedule on the Drawings.

END OF SECTION

SECTION 15897

AIR FILTER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Furnish and install complete air filter assemblies of the types, sizes and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Include complete performance data at the scheduled operating conditions; dimensions; weights; performance curves; airside pressure losses; quantities; descriptions; and any other necessary information.

PART 2 - PRODUCTS

2.1 GENERAL

A. Filters shall pass applicable air quantities at velocities and pressure drops which are within manufacturer's recommended operating ranges and as specified and scheduled.

B. Filter Manufacturers: Continental; American Air Filter; Cambridge; Farr; Flanders; Purafil; or equivalent.

C. Filter Housing Apparatus Manufacturers: Same manufacturer as the applicable filters or same manufacturer as the air handling unit in which installed, whichever manufacturer is applicable.

D. Air Handling Unit Filter Sections: Shall be of adequate size to accept specified filters. Air handling unit filter sections shall be factory made by air handling unit manufacturer or by filter manufacturer to be specifically compatible with applicable air handling unit.

E. Fan Coil Unit and Fan Powered Terminal Unit Filter Box: Integral part of fan coil unit or terminal unit assembly.

1. Access: Filter sections shall be designed for side service access unless otherwise indicated.

2.2 REPLACEABLE THROWAWAY FILTERS, 1-INCH THICK

A. Dacron or fibrous glass multi-ply fiber with 3 graduated density plies. Equal to Continental Conoply Type LD 3 ply, AAF 5700. Galvanized steel or aluminum or fiberboard frame suitable for mounting in applicable filter box. Minimum efficiency: 25% NBS atmospheric

dust spot efficiency. Applicable uses: fan coil units; fan powered terminal units at heating coils contained therein.

2.3 INITIAL PREFILTERS FOR AIR HANDLING UNITS

A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)

B. Filters: Extended surface, pleated panel type; disposable; double-wall chipboard frame with diagonal support members; 2-inches thick; average efficiency no less than 25-30% based on ASHRAE 52.2-99 test method; operate at an initial resistance of not more than 0.25-inches w.g.s.p. at 500 fpm face velocity. Design base: Farr 30/30.

2.4 FINAL PREFILTERS FOR AIR HANDLING UNITS

A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)

B. Filters: Air filters shall be high performance, extended area, deep pleated, disposable type. They shall consist of a filter element, media retainer holding frame and sealer frame. The filter element shall be of the high performance, pre-formed, deep pleated, disposable type. The media shall be microfine glass fiber which is reinforced by a laminated synthetic backing. The filter shall have an average efficiency of 80-85% on ASHRAE Test Standard 52.2-99. It shall have an average arrestance of no less than 98%. The filter shall be listed by Underwriters' Laboratories as Class 1.

C. Media retainer: shall be of welded steel construction and shall be designed in such a manner that it supports the multiple pleats of the filter element against the direction of airflow. The media retainer shall be PVC coated and designed to totally eliminate the possibility of oscillation and/or sagging. Holding Frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and four spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without the use of tools. Sealer frames shall be fabricated of 20 gauge galvanized steel and shall be equipped with gasketing material on the rear flange of the sealer frame.

D. Design Base: Farr HP-100.

2.5 EXTERNAL FILTER HOUSING FOR AIR HANDLING UNIT FILTERS

A. Filter Housing: Holding frame of galvanized steel reinforced with bracing and gussets; constructed to provide positive air seal and retainage of filter elements; doors equipped with heavy duty latches and resilient gasketing; designed for side access. Housing shall accept both initial and final prefilters. Applicable uses: where filter housing is not an integral part of air handling unit assembly. Design base: Farr Model 3P Universal Glide/Pack.

PART 3 - EXECUTION

3.1 GENERAL

A. Arrangement and Access: Arrange, install and make provisions for easy access to and removal and replacement of filters. Provide access doors and/or panels as necessary.

B. Coordination and Matching: Coordinate assembly components and properly match sizes and quantities of filters with related air moving systems (e.g., air handling units, fan coil units, filter banks) so that filter assemblies will operate in accord with operating conditions, sizes and capacities as listed in this section or as otherwise indicated.

3.2 MANOMETER

A. Provide a filter manometer for each separate filter bank type (e.g., initial prefilter bank, final prefilter bank) of each air handling unit filter assembly. Do not provide for fan coil units or terminal units. Units shall be complete with pressure fittings, tubing, vent valves, lags, fluid, and the like as required for a complete installation. Acceptable: Dwyer Series 250-AF with pressure range as applicable for filter bank. Not required for fan coil units. Manometers shall be installed in strict accordance with the manufacturer's instructions and in a manner which will not compromise filter access. Provide mounting brackets as required for proper installation. Set red and green signal flags for proper indication of status of the filters involved.

3.3 MISCELLANEOUS SUPPORT STEEL AND HARDWARE

A. Provide as required to provide for adequate support and structural integrity of each filter bank. In no case shall supplementary supports be less than those indicated or recommended by the filter manufacturer in his standard installation instructions.

3.4 FILTER ASSEMBLY LOCATIONS

A. Where scheduled and shown on the drawings.

3.5 ORIGINAL AND SPARE FILTER SETS

A. Provide an original filter set and two (2) spare filter sets for each unit having an air handling equipment filter assembly specified above. Upon initial start-up, each filter assembly shall be provided with a complete original filter set. Prior to or at the time of final test and balance, this original filter set shall be replaced with a complete new spare filter set. However, if at the time of final test and balance there is still useful operating life remaining in the initial filter set (i.e. the filters are still operating within their recommended pressure drop limits for the particular application), then the Contractor (if he is given written approval by the final test and balance agency) may give the spare filter sets to the Owner (at a place of the Owner's selection on the site) in lieu of replacing the original filters with the spare filters.

END OF SECTION

SECTION 15898

AIR PURIFICATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.2 REFERENCED CODES & STANDARDS

A. The following codes and standards are referenced through out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867

1.3 RELATED WORK

A. Testing, Adjusting and Balancing

B. Facility Access and Protection

C. Ductwork

D. Filters

E. Water and Refrigerant Piping

F. Electrical Wiring

G. Control Wiring

1.4 QUALITY ASSURANCE

A. The Air Purification System shall be a product of an established manufacturer within the USA.

B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

C. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.

D. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturers specified.

B. Acceptable Manufacturers: Plasma Air, Global Plasma Solutions.

C. All other Suppliers of comparable products requesting prior approval shall:

1. Submit for prior approval in accordance with the requirements of Section 15010.
2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included.

2.2 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.
B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system.

E. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):

a. Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
c. Manufacture shall demonstrate that no voltage potential exists due to exposed electrical components.

F. Air Handler Mounted Units:

1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and associated power supplies. All interconnecting wiring shall be UL and NEC NFPA 70 approved. Electrical contractor shall provide a [<120Volt>, <230 Volt>] circuit to the ion generators.

G. Ionization Requirements:

1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.

a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 110VAC to 208VAC to 240VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable.
c. Ionization output from each electrode shall be a minimum of 15 million ions/cc when tested at 2" from the ionization generator.
2. Ozone Generation:

a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation.

H. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 115 VAC to 240VAC, 1 phase, 50/60 Hz.

I. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.
2. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2 ASSEMBLY & ERECTION: PLASMA GENERATOR WITH BI-POLAR IONIZATION

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

A. Provide the manufacturers recommended electrical tests.

3.4 COMMISSIONING & TRAINING

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

SECTION 15910

DUCT SYSTEM ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all necessary duct system accessories to assure proper balance, quiet and draftless distribution and conveyance, and minimization of turbulence, noise and pressure drop for all supply return, exhaust and ventilation air quantities indicated.

B. Items Included: This section generally includes, but is not limited to, the following items as may be applicable to this project:

1. Flexible duct connections.
2. Splitters.
3. Turning vanes.
4. Extractors.
5. Manual volume dampers.
6. Access doors.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:

1. Ductwork.
2. Air distribution devices.
3. All types of air handling equipment.

1.4 COORDINATION

A. Coordinate all items affecting the duct systems including but not limited to the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs, structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work.

1.5 SHOP DRAWINGS

A. Include complete data on: access doors; flexible connectors; manual volume dampers including operating hardware; extractors; turning vanes; automatic shutters and all other items.

B. See section entitled, "General Mechanical Provisions".

1.6 OTHER REQUIREMENTS

A. Provide all components in accordance with manufacturer's recommendations.

B. All ductwork dimensions indicated which may affect items of this section are nominal free clearance internal dimensions which do not include insulation thickness.

1.7 DEFINITIONS

A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc.".

PART 2 - PRODUCTS

2.1 GENERAL

A. Be recommended by the manufacturer for the application.

B. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Ventfabrics
2. Barber-Colman
3. Tuttle & Bailey
4. Dura-Dyne
5. Airsan
6. Titus
7. Anemostat
8. Young
9. Metalaire
10. United McGill

C. Products which are specified may not necessarily all be required on the projects; provide those products which are applicable.

2.2 FLEXIBLE DUCT CONNECTIONS

A. Provided where air handlers, fans and blowers connect to their ductwork.

B. At least 4 inches long.

C. Connected on each side to metal (either metal ductwork, air handling apparatus, or heavy gauge steel sleeves).

D. For use in high and/or low pressure duct systems.

E. Ventfabrics, Inc., "Ventglas Metaledge", or equivalent.

2.3 SPLITTERS

A. Provide for adjustment of air volume to their respective branches, where indicated. Constructed of at least the same gauge galvanized steel as the duct wherein they are used, and in no instance be less than twenty-two (22) US gauge. Use in low pressure duct systems only. Be adequately sized to close off air to applicable branches. Rigidly attached to pivot rod and operating linkage. Install on raised insulated base when used in internally

insulated ductwork. Splitter blades; formed in two thicknesses of metal so that entering edge presents rounded nose to air flow; length no less than one and one half times the width of the smaller branch served or twelve inches, whichever is larger. Hardware used for the construction, assembly, and operation of splitter dampers shall be as follows:

1. Operators for exposed splitters and those located above "lay-in" or accessible ceiling shall be Ventlok #690 splitter damper assembly.
2. Operators for concealed splitters shall be Ventlok #691 with #680 miter and #677 concealed regulator.

2.4 LOW PRESSURE METAL TURNING VANES

A. Provide in all elbows, bends and tees of all low velocity supply air ducts whether or not shown in detail; provide in all elbows, bends and tees of all other low velocity ducts where portions of such ducts convey air at greater than 700 fpm average velocity. Adequate rigidity and strength to be completely flutterproof; properly designed; permanently fixed type. Aluminum, or steel with acid/solvent chemical corrosion resistant coating, or galvanized steel. Air foil type in all mitered elbows, mitered bends and tees. Air foil type must be manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Barber-Colman or other approved manufacturer. Be Barber-Colman "Airturns", Tuttle and Bailey "Ducturns", or Dura-Dyne "VR" with 24 gauge rails and hollow vanes, or equivalent.

2.5 HIGH PRESSURE TURNING VANES

A. None required for this project.

2.6 EXTRACTORS

A. Provide at rectangular branch duct take-offs.

B. Use in low pressure duct systems only.

C. Properly designed to deflect, proportion and direct the indicated air quantities to the branch duct and/or to the registers, grilles or other outlets without causing objectionable noise or pressure drop.

D. Multivaned and adjustable.

E. Aluminum, or steel with acid/solvent chemical corrosion resistant coating, or galvanized steel.

F. Provided with devices for adjusting and securing the position of these deflectors; these devices shall allow adjustment of the deflectors from outside the completed ductwork without necessity for puncturing or otherwise penetrating ductwork and/or its vapor barrier.

G. Made by Titus, Tuttle and Bailey, Metalaire, Anemostat, Waterloo, Barber-Colman, or equivalent.

H. Be similar to Titus Model AG-45 or AG-225 Volume Extractor, Tuttle & Bailey Type VCL or VLK Vectrol, Waterloo Type DTM or DT2M Extractor, Anemostat "DTB" or "DTA" or Young Regulator "890" or 890A", or equivalent.

2.7 MANUAL VOLUME DAMPERS

A. These dampers are to be other than those specified as being integral with each register, diffuser and other air outlet or inlet.

B. Provided where indicated in the complete air distribution system(s) (including ductwork, return air plenums, etc.) to allow complete balancing of the air supply, return, ventilation and exhaust system(s).

C. Opposed blade type.

D. 8" maximum blade width.

E. Made of galvanized steel, steel with acid/solvent chemical resistant coating, or steel with a sprayed or dipped aluminum rust resistant finish; flutterproof.

F. Provided so that all damper adjustment can be made from outside the completed ductwork without necessity for puncturing or otherwise penetrating the ductwork and/or its vapor barrier.

G. Fully adjustable and with locking device.

H. Manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Greenheck or equivalent.

I. Provided at a point in the ductwork which is a sufficient distance upstream from an outlet (or downstream from an inlet) to attenuate objectionable noise due to damper throttling and to preclude adverse effects on the distribution device.

J. Based upon location of the duct in which the damper is to be installed, provide the following types:

1. Dampers in ducts which are exposed or located above "lay-in" or "accessible ceilings": Young Regulator Company Model 817 or equivalent.
2. Dampers in ducts concealed above plaster ceilings or behind dry wall construction: Young Regulator Company Model 817A or equivalent.

K. Use in low pressure duct system only.

2.8 LOW PRESSURE DUCT ACCESS DOORS

A. Provided for: each manual and motorized damper; fire damper; smoke damper; electric duct heater; and where access is otherwise necessary.

B. Factory prefabricated double wall insulated type of 24 US gauge galvanized steel (of same or thicker gauge than ductwork panel in which installed, whichever is greater).

C. Minimum size shall be as large as is compatible with duct size but in no case less than the following (provide larger sizes if necessary to permit proper access operation):

Max. Duct Dimensions	Access Door Size
11" and less	10" x 12"
12" through 16"	12" x 16"
17" and over	16" x 24"

D. Doors shall be provided with and operated adjustable tension catches and shall be completely gasketed around their perimeters. Doors shall be Ventlok "Access Doors". Install in accordance with manufacturers recommendations using Ventlok #360 sealant or equivalent.

2.9 TEST OPENINGS

A. Furnish and install gasketed capped test openings for test equipment (pitot tubes, etc.) on the entering and leaving sides of air handling unit and other air handling equipment and heating coils. Test openings shall be Ventlok #699-2 or equivalent.

2.10 PREFABRICATED DUCT CONNECTIONS

A. At Contractor's option, prefabricated duct connections as manufactured by Ductmate (or approved equal system) may be used in locations and applications for which the duct connection system is recommended. Use of these connections must meet or exceed specified duct construction quality as related to structural rigidity, pressure, accessibility and other such requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. Construct and install all accessories in accordance with the latest indicated editions of applicable SMACNA construction standards.

B. Provide all mitered elbows with turning vanes.

C. Install all duct system accessories in accordance with manufacturer’s recommendations.

D. All accessories installed in poly-vinyl-steel ductwork shall have acid/solvent chemical corrosion resistant coating.

E. All manual damper arms shall be tagged with fluorescent colored strip.

END OF SECTION

SECTION 15933

TERMINAL UNITS: VAV, SINGLE INLET, ELECTRIC COIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide single inlet, variable air volume (VAV) terminal units of types, sizes and capacities indicated.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Include: complete performance data at the scheduled operating conditions; dimensions; performance data; pressure loses; descriptions; discharge and radiated sound power levels at the stated conditions.

1.5 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Envirotech
2. Titus
3. Trane

1.6 TERMINOLOGY

A. The word "box" or "terminal unit" used throughout this section without any modifying adjective shall mean the entire terminal unit assembly including all other accessories integral therewith, unless otherwise indicated. Terminal units may be referred to as "TU".

1.7 NOISE CRITERIA

A. Unless otherwise indicated on drawings, the following noise criteria comprise the basis upon which the selected terminal units must be rated in order to comply with the design limits for allowable NC levels:

1. All sound power level decibels are referenced to 10 to the minus 12 watts.
2. Room outlet NC sound pressure levels specified for these TUs are based on 10db room absorption.
3. Room radiated NC sound pressure levels specified for these TUs are based on 10db room absorption plus 13 NC ceiling sound transmission loss.

4. The maximum allowable NC level in any occupied space (unless otherwise indicated) shall not exceed NC35 as a result of radiated or discharge noise from any terminal unit.

1.8 SELECTION

A. Terminal units shall be selected for maximum air discharge within the mid-range of the TU rating so that field adjustment of maximum indicated discharge air quantity may be made plus and minus 15%

1.9 LEAKAGE

A. Terminal units intended for full shut-off operation shall not have air leakage of more than 2% of nominal box capacity when inlet pressure is 6.0 inches w.g.

1.10 PRESSURE DROP

A. Maximum allowable static pressure drop across the control box portion of any terminal unit (i.e., excluding any applicable companion sound attenuator or heating coil) shall not exceed 0.20 inches w.g. or the value(s) scheduled on drawings. Maximum allowable minimum operating pressure of the entire unit shall not exceed 0.50 inches w.g.

PART 2 - PRODUCTS

2.1 TERMINAL UNITS

A. Control Unit: Galvanized steel or aluminum casing; insulated internally to prevent condensation (comply with NFPA 90A); acoustically treated to reduce noise level; air quantity indicator; access panel(s) for complete access to all parts of the assembly which may require service, maintenance and repair.

B. Sound Attenuators: Factory made companion items to the control box. Provide when either of the following conditions exist:

1. If companion sound attenuators are indicated on the drawing schedule.
2. If companion sound attenuator must be provided in order to comply with the noise criteria limits indicated.

2.2 ELECTRIC REHEAT COILS

A. Performance: Provide complete electric heating coil assemblies of size, capacities and characteristics indicated on the drawings.

B. Coil Requirements:

1. Electric coils shall be supplied and installed on the terminal by the terminal manufacturer. Coils shall be ETL listed. Coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge a minimum of 5 inches to prevent damage to elements during shipping and installation. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3.5 inches apart, staggered for maximum thermal transfer and element life and balanced to ensure equal output per step. The integral control panel shall be housed in a NEMA 1 enclosure with hinged access door for access to all controls and safety devices.
2. Electric coils shall contain a primary automatic reset thermal cutout, a secondary manual reset thermal cutout, differential pressure airflow switch for proof of flow, and line terminal block. Unit shall include an optional integral door interlock type disconnect switch that will not allow the access door to be opened while power is on.

Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

2.3 CONTROL REQUIREMENTS

A. Pressure Independent Operation: Terminal units must operate independent of inlet pressure fluctuations in the main or branch duct system. Units must have controls which are factory installed, factory calibrated and factory tested to be pressure-independent. This pressure-independent feature must be a standard catalogued feature or available and provided as a standard catalogued option.

1. Units shall maintain constant discharge flow for any given setpoint with any variation in inlet static pressure between 0.2 inches w.g. and 6.0- inches w.g.
2. All terminal units must be factory set for design air flow and for minimum air flow.

B. Adjustment: Unit must have capability for easy field adjustment of maximum and minimum air quantities by resetting of control mechanism(s) on terminal unit.

C. Operation:

1. Discharge volume setting shall be controlled throughout indicated variable volume operating range as dictated by the controller which signals air flow requirements.
2. Controls integral with the terminal unit shall be provided by the terminal unit manufacturer. This includes damper motors and similar items. These controls shall not consume more than 0.020-scfm at 20-psig control supply air pressure if controls are pneumatic.
3. Controls must be completely compatible in all respects with the related components of the building temperature control system.

D. Refer to section describing control operation and to control diagrams for coordination.

E. Sensor: In addition to other requirements, the terminal unit shall have an inlet flow/pressure sensor which is designed to operate in conjunction with variable air volume exhaust hood control systems where applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location with all ducts, beams, joists, conduit, lights, piping, air distribution devices and other items in immediate vicinity of indicated locations. Make minor adjustments in exact locations shown to best fit available space.

B. Make all duct connections to and from boxes in as streamlined a manner as practical so that air pressure drop is minimized. Make such connections air tight at operating pressures encountered. Coordinate exact box location and inlet duct connection so that any straight diameters of inlet duct are provided as may be required by the terminal unit manufacturer for proper operation.

C. Locate boxes so that access for repair, maintenance and adjustment is easily facilitated without removal of other permanently located items which are in the immediate vicinity of boxes (this excludes removable ceiling panels, removable air distribution devices attached to flexible ductwork and other similar items).

D. No terminal unit outlet (including companion sound attenuator, if needed) shall be nearer than 60-inches from the first flexible duct connection take-off to the first downstream air distribution device.

E. Coordinate controls to take into account revere or direct acting thermostats, whether TUs are normally open or normally closed, and similar interfacing.

F. Provide proper pipe connections.

END OF SECTION

SECTION 15940

AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide all air distribution devices as indicated on the drawings and as specified herein for a complete and operable system.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

B. Coordinate with work of the ceiling, drywall and plastering trades as required to insure an orderly progression of work and a first class finished system with respect to placement, alignment, finish, general fit and absence of conflict with lighting systems and fire protection systems.

Insulate air distribution devices to prevent condensation formation.

1.4 DESIGN CONDITIONS

A. Acoustical: Noise produced at each diffuser, register, grille or other air distribution device shall not exceed a noise criteria level of NC 35 based on sound pressure levels in db re 0.002 microbars unless otherwise indicated. Coordinate air distribution devices, sound attenuation measures and equipment actually provided to insure that this design constraint is not exceeded by the system installed.

Exceptions: Any particular rooms or areas which are normally occupied by other than maintenance staff or service staff and which may be noted on the drawings as requiring lower NC criteria.

B. Pressure Drop: Pressure drop across any air distribution device shall not exceed 0.15 in wg static pressure unless otherwise indicated.

1.5 SHOP DRAWINGS

A. Refer to the requirements of Section entitled "General Mechanical Provisions".

1.6 MANUFACTURER

A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Titus
2. Metalaire
3. Price

4. Krueger
5. Carnes

B. Manufacturers must be members of the Air Distribution Council unless otherwise indicated.

1.7 OTHER REQUIREMENTS

A. All aluminum is to be extruded unless otherwise indicated.

B. Appearance: Each air distribution device which has a portion thereof (frame, core, etc.) exposed to view in the finished area shall have a factory applied finish which matches and is compatible with the color of the surrounding surface on which the device is installed. Colors must be approved by Architect prior to device fabrication.

C. All louvers, dampers and/or shutters shall be rated by their manufacturer in accord with AMCA Standard 500-74.

D. Integral Components: All dampers, blank-off baffles and other companion devices which form an integral part of air distribution device shall be factory made items produced by the manufacturer of air distribution device.

E. Louvers: Louvers may be specified in another division but for reference may also be indicated on mechanical drawings.

F. Door Grilles: Door grilles may be specified in another division but for reference may also be indicated on mechanical drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the following air distribution devices as applicable to this project. Refer to air distribution device schedule as shown on drawings.

2.2 OTHER REQUIREMENTS

A. All devices must each comply with the applicable portions of the Air Diffusion Council (ADC) Equipment Test Code 1062R4 "Certification, Rating and Test Manual", the Air Movement and Control Association, Inc. (AMCA) Standard 500 "Test Method for Louvers, Dampers and Shutters" and the "National Fire Protection Association" (NFPA) Standard 90A "Installation of Air Conditioning and Ventilating Systems".

B. Provide ceiling and/or linear 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 which will contain each type of diffuser.

C. Diffusers, grilles and registers installed in fire rated ceiling, or floor/ceiling assemblies shall be constructed of steel.

D. Mounting Screws: Where grilles, diffusers or registers are specified which require mounting screws visible from the face of the device these screws shall be furnished with the air distribution equipment and be finished at the factory to match the finish on the grille, diffuser or register in which they are to be used.

PART 3 - EXECUTION

3.1 GENERAL

A. Install neatly where indicated in accord with manufacturer's recommendations and in accord with SMACNA recommendations and as otherwise indicated.

B. Properly test, balance and adjust to produce quiet, draftless operation to best degree possible.

3.2 INSTALLATION

A. Rectangular Diffusers: Where diffusers are the lay-in type, they shall be supported by the inverted T-bar suspension system but all ducts connected thereto shall be supported independently of the ceiling as specified under Section entitled "Ductwork". Surface mounted diffusers shall be supported by the duct runouts or drops where sheet metal ducts are indicated and by separate hangers where flex runouts are indicated. All rectangular ceiling diffusers shall be installed with their lines parallel and perpendicular to the building line and properly aligned with the ceiling.

B. Sidewall Grilles and Registers: Mount securely to the duct system flanges using finish screws and in accordance with accepted good practice.

C. Ceiling mounted Exhaust and Return Registers/Grilles: Mount as specified hereinbefore for surface mounted ceiling diffusers except use finished screws provided and secure to duct and finished ceiling (or finished ceiling for nonducted returns) in accordance with the manufacturer's instructions. Where required to provide adequate support for nonducted registers or grilles, provide appropriate mounting frame for incorporation into the ceiling system.

D. Install all outlets and inlets as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.

E. Locate ceiling air outlets and inlets as indicated on the drawings. Unless otherwise indicated, locate units in center of acoustical ceiling modules. Install square and parallel with partitions, ceiling grid members, etc.

F. Spare Parts: Furnish to Owner, with receipt, 3 operating keys for each type of outlet and inlet that require them.

G. Do not install blank-offs under continuous linear diffuser distribution plenums. Distribution plenums shall cover only active portion of the diffuser.

3.3 PROTECTION OF WORK UNTIL FINAL ACCEPTANCE

A. Coordinate the installation of the air distribution equipment with related work and finishing of adjacent surfaces to prevent damage to the devices or adjacent finishes. Protect the finish of all air distribution equipment until final acceptance. Replace or repair to the Architect's satisfaction any damaged equipment.

END OF SECTION

SECTION 15950

DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components.

1.2 GENERAL REQUIREMENTS

A. The Contractor shall furnish and install DDC Controls to interface to the existing Campus Andover Building Management System (BMS) including all necessary hardware, all operating and applications software necessary to perform the control sequences of operation, security functions and lighting control functions as called for in this specification or as shown on the drawings.

B. Lighting Control Interface: (As required / Per plans)

1. The BMS shall control all exterior lighting and interior lighting not controlled by sensor switch devices where required as detailed on plans. Exterior lighting points shall be added to the existing Campus lighting graphics for testing and maintenance by Facilities personnel.

C. Sentry Logic System:

1. Provide programming to incorporate the BMS information into the Campus Sentry Logic System to add critical point alarming, trending, paging, and email notification to selected individuals as requested by Facilities personnel.
2. System must have the capability in place to provide energy/utility information reporting that can be automatically emailed to selected recipients at predetermined time intervals as selected by owner.

D. Energy Reporting & Utility Information (As required / Per plans)

1. Chilled Water Tonnage Calculations: Entering each building there shall be a chilled water flow meter and matched supply and return water temperature sensors. Energy calculations shall be performed to report the tonnage back to the BMS.
2. Electrical Monitoring and Consumption: Provide interface hardware communications bus wiring necessary to interface the BMS system to the switchgear integral meters. Create and map electrical information to the BMS and perform electrical consumption calculations. Display the information graphically on the BMS. Add metered information to the Campus Master ”MeterView” program.

1.3 CONTROL SYSTEM

A. Acceptable Manufacturer:

1. Andover Controls Corporation / Schneider Electric.

B. The control contractor shall have an office within a 50-mile distance of the project site and offers complete maintenance and support services on a 24-hour, 365 day/year basis. This office shall have direct access to or inventory of spare parts and all necessary test equipment required to install, commission, and service the BMS provided.

C. The manufacturer products applies to operator workstation software, controller software, the custom application programming language, building controllers, custom application controllers, and application specific controllers. All other products specified herein regarding sensors, valves, dampers, and actuators, do not need to be manufactured by the above manufacturer.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multi-user, multitasking environment on the campus network and programmed to control mechanical systems. Operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

E. The BMS shall consist of a two-tiered system, an upper level Ethernet TCP/IP network, and a twisted –pair field bus based on BACnet MS/TP. All field bus communications must be routed through Ethernet-based Network Controllers or routers, and not directly through PC workstations or servers. The contractor shall provide all communications media, connectors, repeaters, hubs, and routers necessary for a complete system.

1.4 DDC EQUIPMENT

A. Operator Workstation: Consult with Facilities at the start of the project to determine if additional operator workstations are required. Workstation shall comply with current Information Technology Systems (ITS) standards for the College.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; integral interface equipment; and backup power source.

C. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements of the connected equipment and be full-wave rectifier type.

D. Surge Protection: Three-stage, in-line, power line protector with L to N, L to G, and N to G protection.

1. Manufacturer \ Model: Kele \ HSP-121BT1RU

E. Control Cabinets: NEMA 1 enclosure with internal perforated panel for equipment mounting sized to accommodate all control components and wiring in a clean and orderly fashion.

1. Manufacturer \ Model: Kele \ RET Series

1.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Acceptable Manufacturers:

a. Andover Controls
b. Precon -– Kele
c. Greystone

2. Accuracy: Plus or minus 0.5 deg F at calibration point.

3. Insertion Elements in Ducts: Length as appropriate for duct size; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
4. Averaging Elements in Ducts: Length as appropriate for duct size. Use where prone to temperature stratification or where ducts are larger than 10 sq. ft.

    a. Manufacturer \ Model: Precon \ ST-FZ Series or approved equal

5. VAV/FTU temperature sensors: Provide 4" temperature sensors on the discharge of all Variable Air Volume boxes and Fan Terminal units with reheat.

    a. Manufacturer \ Model: Greystone \ TE200 series or approved equal

6. Insertion Elements for Liquids: 304 stainless-steel probe and socket with minimum insertion length of 2-1/2 inches. Well mounted sensors shall include thermal conducting compound within the well to insure good heat transfer to the sensor. All immersion sensors that are utilized in conjunction with flow meters in Tonnage and BTU calculations shall be a matched pair.

    a. Manufacturer \ Model: Precon \ ST/W Series or approved equal

7. Room Sensor:

    a. Set-Point Adjustment: Yes
    b. Set-Point Indication: None.
    c. Color: White
    d. Orientation: Vertical.

C. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturer: Veris Industries
2. Accuracy: 3 percent full range with linear output.
3. Sensor Range: 0 to 100 percent relative humidity.
4. Room Sensor:

    a. Set-Point Adjustment: None.
    b. Set-Point Indication: None.
    c. Color: White.
    d. Orientation: Vertical

D. Carbon Dioxide Sensors: Non-dispersive infrared; 0-2000 ppm range, +/- 20 ppm accuracy, 4 to 20 mA output, 5-year calibration interval.

1. Manufacturer \ Model: Veris Industries \ CDE/CWE Series

E. Pressure Transducers:

1. Air Pressure Transducers: High-impact ABS plastic panel with LCD display, 0-10" w.c. range, 1% of full scale accuracy, 4 to 20 mA output.

    a. Manufacturer \ Model: Veris Industries \ PX Series

2. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

    a. Manufacturer \ Model: Veris Industries \ PX Series

3. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

   a. AIR – Manufacturer \ Model: Kele \ Model P32 Series
   b. Water – Manufacturer \ Model: Penn \ P74 Series or approved equal

F. Airflow measuring Sensor:

1. Manufacturer \ Model : Ebtron Series

G. Chilled Flow Sensor: Insertion Magnetic Flow

1. Manufacturer \ Model: Onicon \ Model F-3500

H. Safeties:

1. Low Temperature Cut-Out: 20' long vapor-charged sensing element. Sensor shall react to the coldest 18" section of the sensing element. Manual reset required.

   a. Manufacturer \ Model: Johnson Controls \ A11 Series

2. Air Pressure Switch: Snap acting, diaphragm with calibration spring and manual reset button.

   a. Manufacturer \ Model: Cleveland Controls \ AFS-460

1.6 STATUS SENSORS

A. Current Switches: Split-core, self-powered, solid-state, selected to match current and system output requirements.

1. Manufacturer \ Model: Hawkeye \ 600

1.7 RELAYS

A. Pilot Duty Relays: Provide relay with the proper voltage and current ratings most suitable for the controlled application.

1. Manufacturer \ Model: Functional Devices \ RIB Series
2. Manufacturer \ Model: Air Products \ PAM Series
3. Manufacturer \ Model: IDEC \ RH Series with SH Bases

B. Power Duty Relays: Provide power rated relays in applications where there is no contactor or starter required in applications to control low horsepower motors and lighting circuits.

1. Manufacturer \ Model: Functional Devices \ RIB Power Series

1.8 ACTUATORS

A. Manufacturer: Belimo.

B. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

C. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque. Actuators for terminal unit damper control shall be tri-state; all others shall be analog with position feedback.

1.9 CONTROL VALVES

A. Control Valves: Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system, unless otherwise indicated.

B. Pressure Independent Control Valves:

1. Manufacturers:

a. BELIMO AIRCONTROLS (USA), INC.

2. The modulating control valves shall be pressure independent.
3. The control valves shall accurately control the flow from 0 to 100% full rated flow with an equal percentage flow characteristic. The flow shall not vary more than +/- 5% due to system pressure fluctuations across the valve with a minimum of 5 PSID across the valve.
4. Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.
5. Combination of actuator and valve shall provide a minimum close-off pressure rating of 200 PSID.
6. The control valve shall require no maintenance and shall not include replaceable cartridges.
7. All actuators shall be electronically programmed by use of a handheld programming device or external computer software. Programming using actuator mounted switches or multi-turn actuators are NOT acceptable.

a. Actuators for 3-wire floating (tri-state) on ½" – 1" pressure independent control valves shall fail in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow.
b. Actuators for two-position ½'-1" pressure independent control valves shall fail in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow.
c. Actuators shall be provided with an auxiliary switch to prove valve position.

8. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory via a single screw on a four-way DIN mounting-base.
9. The control valve shall require no maintenance and shall not include replaceable cartridges.
10. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
11. The use of pressure independent valves piped in parallel to achieve the rated coil flow shall be permitted. Actuators shall be electronically programmed to permit sequencing the flow with a single control output point. The use of external devices to permit sequencing is NOT acceptable.

C. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

D. Valves 2" and smaller shall be **PICCV** type. Actuators for terminal unit heating coil control shall be tri-state; all others shall be analog with position feedback.

1.10 DAMPERS

A. Acceptable Manufacturers:

1. Ruskin
2. TAMCO

B. Dampers: AMCA Class 1A listed, opposed-blade design; 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; airfoil damper blades with neoprene blade seals mounted on 1/2-inch diameter, zinc-plated axles, with nylon blade bearings and linkages concealed in the frame. Maximum leakage of 3 cfm/sq.ft. at 1" w.g. static pressure.

1.11 WIRING, CONDUIT, AND CABLE

A. All wiring requirements shall conform to the standards outlined in the Electrical Specifications.

B. Conduit is required in all mechanical rooms, equipment rooms, and all concealed spaces.

C. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Plenum rated wiring can be run without conduit above suspended ceilings.

D. Control cable installed in walls shall be in conduit; terminated above ceiling with a bushing.

E. Network cabling if not provided by the owner shall be run as CAT5 plenum rated cable colored Pink.

F. All wire will be copper and meet minimum wire size and insulation class as listed below:

Wire Class	Wire Size	Insulation Class	Wire Color
Power	12 Gauge	600 Volt	N/A
Class One	14 Gauge	600 Volt	N/A
Class Two & Three	18 Gauge	300 Volt	N/A
Infinet Comm.	24 Gauge low cap	300 Volt	Orange
BACnet Comm.	24 Gauge low cap	300 Volt	Org/Blu
MODbus Comm.	22 Gauge	300 Volt	Blue
LON Bus	24 Gauge low cap	300 Volt	Purple

1.12 IDENTIFICATION

A. All control enclosures shall be identified with a phenolic nameplate. The lettering shall be white against a black background unless otherwise directed by the owner.

B. Ceiling grids shall be tagged with a label tag identifying the terminal box number in coordination with the tag located on the associated temperature sensor.

1.13 GENERAL PRACTICES

A. All Primary equipment (Chillers) shall have a local override switch which will bring on the associated piece of equipment in the event of an emergency.

B. All lighting circuits shall have a method of bringing on the controlled circuit in the event of an emergency. This shall be accomplished with either a local override switch or a switch located within the associated DDC Controller. (This applies to exterior and interior lighting circuits that do not have a Hand/Off/Auto provided and installed by the electrical contractor.)

C. The control contractor shall coordinate the alarm delivery options with the owner. This applies to both the alarm selections, thresholds and the delivery locations.

D. Customer shall have access from the BMS to the following:

1. Control Drawings (.pdf format)
2. Product data sheets of components installed.
3. Mechanical and electrical drawings (.pdf format)

E. A copy of the control drawing for each control cabinet shall be placed on the inside door of each control cabinet.

1.14 WORK BY OTHERS

A. The mechanical Contractor shall install all control valves, sensor wells, flow meters, pressure taps, dampers, flow measuring stations and other similar equipment provided by the BMS contractor.

B. The electrical contractor shall provide the following:

1. All power wiring to all VFDS, starters, and motors.
2. Provide line voltage to all terminal box controllers
3. Provide 120 Vac power to control panels.
4. Wiring to all smoke/duct detectors and any devices related to the building fire alarm system.
5. All power wiring to all smoke damper actuators for smoke control sequence.
6. Power wiring to all lighting circuits. Electrical contractor shall provide all lighting contactors. BMS contractor to provide pilot relay when circuits are controlled by the BMS.

END OF SECTION

SECTION 15960

VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

B. The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. All VFDs installed on this project shall be from the same manufacturer.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronic Engineers (IEEE)

a) Standard 519-1992, IEEE Guide for Harmonic Content and Control.

2. Underwriters laboratories

a) UL508C

3. National Electrical Manufacturer's Association (NEMA)

a) ICS 7.0, AC Adjustable Speed Drives

4. IEC 16800 Parts 1 and 2

B. Qualifications:

1. VFDs and options shall be UL listed as a complete assembly. VFDs that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fusing.
2. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.
3. Acceptable Manufactures:

a) ABB ACH550 Series.
b) Alternate manufacturer's requests must be submitted in writing at least 10 working days prior to bid. Approval does not relieve supplier of specification requirements.
c) VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.

1.03 SUBMITTALS

A. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.

2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided. Any portions of the specifications not complied with must be clearly indicated or the supplier and contractor shall be liable to provide all components required to meet the specification.
4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

    a) The VFD manufacturer shall provide calculations; specific to the installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with the IEEE electrical system standard 519. All VFDs shall include a minimum of 5% equivalent impedance reactors, no exceptions.

PART 2 – PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, (NEMA rated enclosures are not acceptable) completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

1. Environmental operating conditions: $0 – 40^0$ C continuous. Altitude 0 to 3300 feet above sea level, up to 95% humidity, non-condensing. All circuit boards shall have conformal coating.
2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD.

B. All VFDs shall have the following features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings. Capacitor backup is not acceptable.
4. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
5. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
6. The VFD shall have 5% equivalent impedance internal reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% equivalent impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.

7. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% equivalent impedance internal reactors.
8. The VFD shall provide a programmable proof of flow Form-C relay output (broken belt / broken coupling). The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

D. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network.
3. Two (2) programmable analog inputs shall accept current or voltage signals.
4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
5. Six (6) programmable digital inputs.
6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
7. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.
8. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
11. The VFD shall include password protection against parameter changes.

E. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (LED and alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words.

F. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

Output Frequency
Motor Speed (RPM, %, or Engineering units)
Motor Current
Drive Temperature
DC Bus Voltage
Output Voltage

G. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback . The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlock, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

H. Serial Communications:

1. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, BACnet, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
2. The BACnet connection shall be an RS485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

    a. Data Sharing – Read Property – B.
    b. Data Sharing – Write Property – B.
    c. Device Management – Dynamic Device Binding (Who-Is; I-AM).
    d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
    e. Device Management – Communication Control – B.

3. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

I. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The VFD shall comply with standard EN 61800-3 for the First Environment, restricted level with up to 100' of motor cables. No Exceptions. Certified test lab test reports shall be provided with the submittals.

J. All VFDs through 60HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not be damaged by this condition.

K. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass enclosure door and VFD enclosure must be interlocked such that input power is turned off before either enclosure can be opened. The VFD and Bypass as a package shall have a UL listed short circuit rating of 100,000 amps and shall be indicated on the data label.

1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses are required. Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted
2. Door interlocked padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

L. The following operators shall be provided:

a. Bypass Hand-Off-Auto
b. Drive mode selector and light
c. Bypass mode selector and light
d. Bypass fault reset
e. Bypass LDC display, 2 lines, for programming and status / fault / warning indications

1. Motor protection from single phase power conditions - The Bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in Bypass mode are not acceptable.
2. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.
3. The Bypass system shall NOT depend on the VFD for bypass operation. The bypass shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the enclosure for repair / replacement.
4. Serial communications – the bypass and VFD shall be capable of being monitored and or controlled via serial communications. Provide communications protocols for ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1) and BACnet in the bypass controller.
5. BACnet Serial communication bypass capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, bypass current (in amps), bypass kilowatt hours (resettable), bypass operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relays output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional bypass status indications and settings shall be transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, and bypass selected. The DDC system shall also be able to monitor if the motor is running under load in both VFD and bypass (proof of flow) in the VFD mode over serial communications or Form-C relay output. A minimum of 40 field parameters shall be capable of being monitored in the bypass mode.

6. Run permissive circuit - there shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, time-clock control, or serial communications) the VFD and bypass shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD system input and allows motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close.
7. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor operation shall be indicated on the Bypass LCD display as well as over the serial communications protocol.
8. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
9. The bypass control shall be programmable for manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass.
10. There shall be an adjustable motor current sensing circuit for the bypass and VFD mode to provide proof of flow indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and on a relay output contact closure.
11. The bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs.
12. The relay outputs from the bypass shall programmable for any of the following indications.

    a. System started
    b. System running
    c. Bypass override enabled
    d. Drive fault
    e. Bypass fault
    f. Bypass H-O-A position
    g. Motor proof of flow (broken belt)
    h. Overload
    i. Bypass selected
    j. Bypass run
    k. System started (damper opening)
    l. Bypass alarm
    m. Over temperature

13. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.
14. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
15. The user shall be able to select the text to be displayed on the keypad when the safety opens. Example text display indications include “Firestat”, “Freezestat”, “Over pressure” and “Low pressure”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
16. Class 10, 20, or 30 (selectable) electronic motor overload protection shall be included.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the requirements of the VFD manufacturer's installation manual.

3.02 START-UP

A. Certified factory start-up shall be provided for each drive by a factory certified service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.03 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.

B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

3.04 WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION

SECTION 15980

PERFORMANCE VERIFICATION, PRELIMINARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Put all work in a state of readiness for final performance verification.

B. Final performance verification shall not begin until the systems are complete and operable in all respects and all related building systems are complete.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

B. Refer to the section which describes "Performance Verification, Final".

PART 2 - PRODUCTS

This section not applicable.

PART 3 - EXECUTION

3.1 WATER SYSTEMS

A. Prepare each water system for balancing in the following manner:

1. Open all valves to the full position, including coil stop valves; close bypass valves, and open return line balancing cocks.
2. Clean all strainers.
3. Examine fluid in each system to determine that it has been treated and is clean.
4. Check pumps for proper rotation.

B. Check expansion tanks for full capacity of water and the absence of air lock.

C. Check all air vents at high points of system for proper installation and free operation. Remove all air from circulating system.

1. Set all temperature controls for full heat or full cooling (as applicable) from all coils.
2. Check for proper operation of any automatic bypass valves.

3.2 AIR SYSTEMS

A. Prepare the air side for balancing in the following manner:

1. All fans, blowers, and air handling equipment shall be mechanically checked and available to operate under design conditions.

2. All splitters, volume dampers, fire dampers, and vanes shall be in their neutral positions.
3. All grilles, diffusers, and like items, shall be installed with dampers, vanes, and blades in their neutral positions.
4. All controls, whether they are electronic, electric or pneumatic or a combination thereof, shall be mechanically checked and ready to operate under design code in an operable and non-overloading condition.

3.3 ADDITIONAL REQUIREMENTS

A. Complete Installation: The Contractor shall complete the equipment and system installation to the satisfaction of the Architect/Engineer (who will be the sole judge of its state of readiness) prior to advising, the writing, that final performance verification is ready to begin. The Contractor is hereby advised that the Certificate of Substantial Completion will not be issued prior to the completion of final performance verification work and that he should therefore, schedule all other work accordingly allowing no less than 60 days for completion of final performance verification.

B. Clean, Flush and Fill Systems: The Contractor shall include the cleaning, flushing, filling, and venting of all hydronic and steam systems; the setup, check-out, and startup of chemical treatment systems; and the setup, checkout and startup of all equipment as work to be complete prior to the start of final performance verification.

C. Correction of Defects: The Contractor shall promptly and properly correct all defects in workmanship, material, installation and equipment of which he is aware prior to requesting that final performance verification work begin. Once the final performance verification work has begun, the Contractor shall promptly correct all defects in workmanship, materials, installation, and equipment as they are called to his attention by Architect/Engineer.

D. Drive Changes: Changes in pulleys or belts required for correct final balance during testing shall be made at no additional cost.

E. Scheduling and Coordination: The Contractor shall be responsible for proper scheduling and coordination of work involved in preliminary performance verification. This shall include, but is not necessarily limited to the timely provision of: mechanics, tools, equipment, correction of defects, equipment manufacturer's representatives, test modules, and all other items which may be required.

F. Report: Submit a written report describing and certifying in detail all preliminary performance verification items and tasks that have been performed. Approval of this report by the Architect/Engineer will precede final performance verification.

END OF SECTION

SECTION 15981

PERFORMANCE VERIFICATION, FINAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Provide the services of an independent test and balance agency to verify the performance of the complete heating, ventilating and air conditioning systems as described by Division 15. Performance verification shall be accomplished by established testing and balancing procedures as described in this section.

1.3 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the Drawings and Specifications.

1.4 TEST AND BALANCE AGENCY

A. All performance verification shall be performed by an independent test and balance agency (herein referred to as the "T & B Agency") which is fully certified by and a current member of the Associated Air Balance Council (AABC).

1.5 CONTRACTUAL RELATIONSHIP

A. Performance verification shall be performed as a service of the T & B Agency directly to the Contractor with no other subcontractors as part of the agreement.

B. Performance verification is specified in this Division 15 only because it relates predominantly to Division 15 work. However, the inclusion in this Division 15 of this section covering performance verification shall not preclude the contractual agreement of the T & B Agency from contracting directly to the Contractor with no other subcontractors as part of such agreement.

1.6 AGENCY APPROVAL

A. Submit the name and qualifications of the proposed T & B Agency to the Architect/Engineer for approval within thirty (30) days of Notice to Proceed.

B. Include AABC National Project Certification Performance Guaranty.

1.7 WORK INCLUDED

A. The T & B Agency shall provide all labor, supervision, professional services, tools, test equipment and instruments (except as otherwise specified) to perform the following work and all other work of this section:

1. Review the automatic temperature control and air terminal unit specifications for their respective and combined effects on the testing and balancing procedures for the air and hydronic systems.

2. Where in the opinion of the T & B Agency conditions may exist in the system design or construction that may have the potential of adversely affecting system performance, then the T & B Agency shall identify the condition and submit in writing recommended correctives for consideration by the Architect/Engineer.
3. During construction, review those shop drawings which have relevance to performance verification to confirm that the required piping, ductwork and equipment, and their respective specialties and accessories such as gauges, valves, dampers, access doors, etc., are properly selected, sized and located to permit proper and complete testing and balancing to be accomplished.
4. Perform site inspections to verify compliance with documents, and observe pressure tests on ductwork.
5. Perform a complete air and hydronic test and balance of all heating, ventilating, air conditioning and exhaust air systems and all water and steam systems shown and described on the Construction Documents and as further described herein.
6. Submit Equipment Test and Systems Balance Report.
7. Furnish specifications to Contractor for properly sized fixed sheaves on fan systems after proper RPM has been established.

1.8 EXISTING SYSTEMS

A. Prior to balancing and testing the new systems, obtain test data on those existing systems which may be affected by the new work. Then, after the new work is provided, rebalance (if and as necessary) those existing systems so that they operate at the same conditions under which they were operating prior to the new work.

B. The above test data shall be provided as part of the test and balance report. The test data shall include the water and air flow rates and temperatures entering and leaving any equipment items which are part of the existing heating, ventilating and air conditioning system. However, only the fluid affected by the new work need be tested (for example, an air handling unit which is unaffected on its airside but which is affected on its waterside need only have water data obtained). Also, if a piping system branch serves a group of units, then only the flow at the existing branch need be measured and not necessarily the flow at each air handling unit served by the branch (unless measurement at each unit is the only way to obtain the branch total flow).

1.9 GUARANTY

A. The T & B Agency shall include a warranty period of ninety (90) days after completion and acceptance of test and balance work. During the warranty period, the Architect/Engineer may request a re-check or re-setting of any system component requiring testing and balancing. The T & B Agency shall provide technicians, instruments, and tools to assist the Architect/Engineer in conducting any test that he may require during this time. The foregoing shall be in addition to the A.A.B.C. National Project Certification Performance Guaranty which shall also be provided.

PART 2 - PRODUCTS

2.1 GENERAL

A. The tangible product of this section shall include the reports and documentation necessary to verify the systems' performance.

2.2 REPORT

A. The T & B Agency shall in the course of his work record the information herein specified. Recorded test data shall be at the final balanced condition for each system. Recorded data shall be arranged by system using the appropriate designation as established on the

Construction Documents. Four (4) copies of the final report signed, bound and indexed shall be submitted to the Architect/Engineer for his approval or comments.

B. Where actual measurements recorded for the final balance show deviations of more than 10% from the design, the T & B Agency shall note same in the report and submit recommendations for corrective action to the Architect/Engineer for his consideration.

C. In those cases where recorded data can be reasonably interpreted to be inaccurate, inconsistent and/or erroneous, the Architect/Engineer may request additional testing and balancing. The T & B Agency shall at no additional cost perform such retesting and rebalancing as directed by and in the presence of the Architect/Engineer.

D. Where, in the opinion of the T & B Agency, there is excessive vibration, movement or noise from any piece of equipment, ductwork, pipes, etc., the T & B Agency shall note same in the report and submit recommendations for action to the Architect/Engineer.

E. The T & B Agency shall verify that each thermostat and the devices it is controlling, such as control valves, motorized dampers, VAV boxes, etc., operate in the exact sequence required.

F. Test Data: Include the following data in the Systems Test and Balance Report:

1. Motors:

   Manufacturer
   Model and serial number
   Rated amperage and voltage
   Rated horsepower
   Rated RPM
   Corrected full load amperage
   Measured amperage and voltage
   Calculated BHP
   Measured RPM
   Sheave size, type and manufacturer

2. Fans:

   Manufacturer
   Model or Serial number, BI or Air Foil - number of blades
   Rated CFM, measured CFM
   Rated RPM, measured RPM
   Measured pressures - Inlet and Outlet Static Pressure
   Pulley size, type and manufacturer
   Belt size and quantity
   Rated TSP
   Operating TSP & operating ESP (at discharge side of
   Supply Fan or suction side of Exhaust/Return Fan)

3. Pumps:

   Manufacturer
   Model or Serial number, impeller size
   Rated RPM, measured RPM
   Rated head, measured head
   Rated pressures
   Measured discharge pressure (full flow and no flow)
   Measured suction pressure (full flow and no flow)
   Measured GPM

Operating head
Operating RPM

4. Air Systems (including inlets and outlets):

Provide single line diagrammatic plan locating each air inlet and outlet and its reference number.
Grille or diffuser reference number and manufacturer.
Grille or diffuser location.
Design velocity.
Design CFM.
Effective area factor and size.
Measured velocity.
Measured CFM
Terminal Unit CFM

G. Other Report Requirements: Where any systems have equipment or components which are not covered by the above, then the Final Test and Balance Report shall include the following data as applicable to such equipment or systems to confirm actual operation:

1. All inlet and outlet areas.
2. All applicable duct, pipe and coil sizes.
3. Outside, inside, mixed and supply air conditions.
4. All fluid velocities, flow rates, temperatures and pressures at appropriate locations.
5. All speeds.
6. All voltage and ampere ranges.
7. Descriptions of each test method used.

2.3 INSTRUMENTATION

A. All test and balance equipment and instruments to be furnished by the T & B Agency shall have been calibrated within six (6) months of use on this work. A list of equipment and instruments to be used shall be submitted to the Architect/Engineer prior to commencing test and balancing operations and shall include equipment and/or instruments, name, manufacturer, serial number and certification of last calibration date. Instruments without calibration adjustment capability shall be accompanied with manufacturer's certification of accuracy. Test and balance equipment and instruments furnished by the Contractor to the T & B Agency shall be accompanied with certification as required above. The T & B Agency shall be responsible for the protection from damage due to accident, abuse or misuse, all equipment and instruments provided by the Contractor, and shall return same in good working condition at the completion of the test and balance work to the Contractor. The T & B Agency shall repair at his expense to original condition and accuracy or replace with like equipment and instruments damaged in the work.

2.4 DIAGRAMS

A. Provide a schematic diagram (i.e., one-line) of duct system(s) tested. Indicate on the diagram the relative location of all air distribution devices, VAV boxes, heating/cooling coils, points of data measurements (i.e., pitot traverse, temperature, static pressure) fans, air handling units, and similar equipment included in the system. Diagram shall identify each component tested. Said identification shall utilize the conventions shown on the drawings (i.e., AHU-1 or SF-6) and correlate with the data sheets provided in the Test and Balance Report.

2.5 LOGS AND FORMS

A. Logs and forms shall clearly indicate following:

1. All inlet and outlet areas.
2. All applicable duct, pipe and coil sizes.
3. Outside, inside, mixed and supply air conditions.
4. All fluid velocities, flow rates, temperatures and pressures at significant locations (e.g., fluid pressures before and after each pump and fan, temperatures and pressures at supply and return headers and at chiller and boiler inlets and outlets, etc.).
5. All fan speeds.
6. All motor ampere ranges.
7. Descriptions of each test method used.

B. Associated Air Balance Council log and data forms.

PART 3 - EXECUTION

3.1 GENERAL

A. Sheaves: The Contractor shall provide applicable fans with V-belt drives and fixed pitch sheaves. In order to provide the properly sized fixed pitch sheave, the Contractor shall initially provide fans with V-belt drives, variable pitch sheaves. The Contractor, upon completion of system balancing by the T & B Agency, will replace these adjustable pitch sheaves with fixed sheaves of the size and type specified by the T & B Agency. The Contractor shall tag the adjustable sheaves, transmit same to Owner, and receive written receipt by Owner of acceptance of these sheaves.

B. Load Conditions: All testing and balancing of systems shall be undertaken with maximum attainable load. Testing and balancing of all air handling systems shall be accomplished with ceiling tile in place and enclosing partitions and doors erected.

C. Observe all equipment and exposed piping for noise, movement or vibrations under normal operating conditions and report excesses to the Architect and Owner.

D. Where patented measuring stations are installed, each of these is to be read and recorded. In the hydronic systems, the permanent devices, such as flow tubes with mercury manometers, annular ring systems, venturi tubes with portable meters, etc. must be used for final measurements after they are completed, calibrated and in satisfactory condition.

3.2 PERFORMANCE VERIFICATION, PRELIMINARY

A. The Contractor, prior to commencement of the balancing by the T & B Agency, shall verify in writing:

1. That strainers have been removed and cleaned.
2. That all air filters have been installed and are in clean condition.
3. That expansion tanks have been inspected and that the system is not air bound and is completely filled with water.
4. That all air vents at coils and high points of the piping systems have been inspected and are installed and operating freely.
5. That all automatic valves, hand valves, and balancing valves have been left or fixed in the open position for full flow through all devices.
6. That all linkages between valves or dampers and their actuators are secure.
7. That all pumps and fans are operating at the specified RPM.

B. The Contractor shall confirm in writing that the systems as scheduled for balancing, are operational and complete and that all piping and ductwork have been pressure tested and accepted and all affected piping systems have been cleaned, flushed and refilled with prescribed treated water and vented.

3.3 PROTECTION OF WORK

A. The Contractor shall protect all mechanical devices during the testing and balancing period. The activities of the T & B Agency will include but not be limited to the adjustments of designated balancing devices including; adjustment of balancing dampers, adjustment of inlet vane dampers, adjustment of air extractors, air splitters, or manual dampers, the adjustment of adjustable sheaves for fan speed, the adjustment of balancing valves, or similar devices. The existence of the T & B Agency shall not relieve the Contractor of his responsibility for the complete operation of the mechanical systems in conformance with the contract documents.

3.4 CORRECTION OF WORK

A. The Contractor shall at no additional cost to the Owner rectify discrepancies between the actual installation and contract documents when in the opinion of the T & B Agency the discrepancy will significantly affect system balance and performance.

3.5 COORDINATION AND ASSISTANCE

A. The Contractor shall assist the T & B Agency by providing all labor, equipment, tools and material required to operate all of the equipment and systems necessary for the testing and balancing of the systems and for the adjustment, calibration or repair of all electric or pneumatic or automated control devices and components. These services shall be available on each working day during the period of final testing and balancing. The Contractor shall assist the T & B Agency by arranging to have all ceilings, partitions, windows, and doors installed prior to the scheduled commencement of balancing within each specified area.

B. The Contractor shall provide to the approved T & B Agency a complete set of plans and specifications and an approved copy of all heating, ventilating and air conditioning equipment shop drawings. The Contractor shall include the cost of all pulley, belt, and drive changes, as well as balancing dampers required to achieve proper system balance recommended by the T & B Agency.

3.6 AIR SYSTEMS

A. The testing and balancing shall include, but is not limited to, the following requirements:

1. Adjust fan speeds to deliver the required cfm and static pressure, and record rpm and full load amperes.
2. Make pitot tube traverse of main supply ducts to verify design cfm. Seal duct access holes with rubber or metal snap-in plugs.
3. For each supply air system, verify the quantity of outside air and return air when the system is operating in the maximum cooling and full heating modes.
4. Test and adjust each diffuser, grille and register to within 10% of design requirements, and also adjust so as to minimize drafts in all areas.
5. Observe all equipment and exposed ductwork for noise, movement or vibration under normal operating conditions and report excesses to the Architect/Engineer.

B. After all air distribution devices have been balanced to distribute calculated design indicated air quantities and if temperature in any area (where such area does not have the particular zone temperature control thermostat located therein) of any zone is not maintained within 2 degrees plus or minus of the zone areas which does have the zone temperature control thermostat, then notify Architect/ Engineer of such conditions and obtain approval to rebalance devices to obtain air quantities other than those indicated so that air temperature in entire zone will be as even as possible regardless of calculated design air quantities. After obtaining approval to rebalance, perform such necessary rebalancing.

3.7 HYDRONIC AND STEAM SYSTEMS

A. The testing and balancing shall include, but is not necessarily limited to, the following requirements as applicable to either or both the hydronic systems and steam systems:

1. Prior to testing and balancing of each system check all flow meters for proper installation, calibration and accuracy.
2. Measure and adjust pump flow capacity to proper quantity.
3. Adjust flow through chillers.
4. Adjust flow through any heat exchangers.
5. Balance system flows.
6. Coordinate equipment operation and output performance with the manufacturer's representative. Record inlet and outlet temperatures.
7. Mark or otherwise record settings of adjustable balancing devices which provide the design flow requirement.
8. For each hydronic system record flow rate, pump inlet and outlet pressures and motor amperage for each pump for each increment of system flow rate provided by the pumping/piping configuration. Variable speed pumps shall operate as constant volume pumps at maximum speed for purposes of this record.

END OF SECTION

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Coordination of work between mechanical and electrical trades is covered in Division-15 Section “GENERAL MECHANICAL PROVISIONS”.

1.2 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to all sections of Division-16. It expands and supplements the requirements specified in sections of Division-1.

1.3 CODES AND STANDARDS

A. Install all work in accordance with the applicable requirements of the latest edition of the following:

1. National Electric Code (NEC)
2. Local, State, County and City Codes
3. National Fire Protection Association (NFPA)
4. American National Standards Institute (ANSI)
5. NEMA Standards

B. It is the intent of the Contract Documents to comply with the applicable codes, ordinances, regulations, and standards. Where discrepancies occur, notify the Architect in writing, and ask for interpretation. Correct any installation that fails to comply with the applicable codes and standards at no additional cost to the Owner.

C. All materials shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

1.4 PERMITS AND INSPECTIONS

A. Obtain and make all payments for permits and inspections required. At the completion of the project and before final acceptance of the electrical work, provide evidence of final inspection and approval by the authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical products specified, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with electrical work similar to that required for this project.

1.6 IDENTIFICATION

A. The following items shall be equipped with nameplates: All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, panelboards, circuit breakers, contactors.

B. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, branch (normal or emergency), voltage and phase of the supply. For example, "Panel A, Emergency Branch, 480Y/277V, 3-phase, 4-wire."

C. Nameplates shall be laminated phenolic plastic, black front and back with white core, with 3/8" high lettering etched through the outer covering. White engraved letters on black background. Attach with plated self-tapping screws or brass bolts.

D. Provide nameplates on all existing equipment that a circuit under this contract is fed from.

E. All junction box covers shall be hand marked with a 1/8" wide permanent black marking pen, indicating panel and circuit numbers contained, or system contained, i.e., fire alarm, telephone, etc.

1.7 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected, and architectural room elevations.

1.8 ELECTRICAL INSTALLATIONS

A. Coordinate electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

G. Coordinate connection of electrical systems with local utility services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connections for each service.

1.9 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

D. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

E. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed work;
2. Remove and replace defective Work;
3. Remove and replace Work not conforming to requirements of the Contract Documents;
4. Remove samples of installed Work as specified for testing;
5. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
6. Install electrical work in existing facilities.

1.10 ELECTRICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division-1 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/Engineer will not be processed.

1.11 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division-1 for requirements in selecting products and requesting substitutions. Where a listing of acceptable manufacturers has been given, use one of those manufacturers given only.

1.12 PRODUCT LISTING

A. Prepare listing of major electrical equipment and materials for the project.

B. Provide all information requested.

C. Submit this listing as a part of the submittal requirement specified in Division-1.

D. When two or more items of the same material or equipment are required they shall be of the same manufacturer, i.e., panelboards, motor starters, transformers, etc. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

E. Provide products which are compatible within systems and other connected items.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.14 RECORD DOCUMENTS

A. Refer to the Division-1 Section: PROJECT CLOSEOUT or PROJECT RECORD DOCUMENTS for requirements. The following paragraphs supplement the requirements of Division-1.

B. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details.

C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.15 OPERATION AND MAINTENANCE DATA

A. Refer to the Division-1 Section; PROJECT CLOSEOUT or OPERATION AND MAINTENANCE DATA for procedures and requirements for preparation and submittal of maintenance manuals.

1.16 WARRANTIES

A. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division-16, into a separate set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.17 CLEANING

A. Refer to the Division-1 Section; PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

B. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps.

1.18 TEMPORARY POWER

A. Provide and pay for all temporary electrical service as required for construction.

B. Provide all temporary lighting and power distribution as required for construction. All temporary electrical work shall be in accordance with the N.E.C.

1.19 ELECTRONIC FILES

A. CADD files will be available on a limited basis to qualified firms at the Architects prerogative. The cost of the files will be $100 per sheet. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.

1. A request for CADD files should be delivered in writing along with payment for such files. Files will not be processed until payment is received.

1.20 EXISTING CONDITIONS

A. Prior to bid, the Contractor shall visit the existing facility and become familiar with existing conditions. Contractor shall include in his bid price, allowances for work to be performed in the existing operational areas of the facility. All work in existing operational areas shall be coordinated and scheduled with the facility, and may have to be performed during non-normal working hours.

B. Existing piping, conduit and ductwork are located in areas of construction under this Contract. Contractor shall relocate or modify any existing piping, conduit or ductwork. Shutdown of existing systems for relocation shall be coordinated with the facility.

C. Before any construction begins, it shall be the responsibility of the Contractor to investigate and coordinate proposed new ceiling heights with existing conditions and ceiling space requirements for new lighting fixtures, ductwork, sprinkler, plumbing, piping and conduit systems.

D. It shall be the Contractor's responsibility to adjust existing and new ductwork, sprinkler, plumbing, piping and conduit systems to accommodate the work in the ceiling height provided. Architect shall be notified before construction begins if any ceiling space is not adequate for the work shown.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater Cables: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

3. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Division16 Section "Electrical Identification" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 16073

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 15 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer load shedding.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION

SECTION 16120

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

C. NO MC CABLE ALLOWED

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

H. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

a. Main Distribution Switchgear and ATS

2. Perform each visual and mechanical inspection and “megger” test all feeders to all switchgear. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetal conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. FMC: Comply with UL 1; zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1or Type 3R (outdoors) unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Shape: Rectangular.
3. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-80-PVC.
2. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: RNC.

2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.
    e. Parking lots.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Division 16 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. A. Support conduit within 12 inches of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Division 16 Section "Electrical Identification."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches
4. Communications outlets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

2.5 OCCUPANCY SENSORS

A. Wall-Switch or Ceiling Mounted Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.
f. Sensor Switch

2. Description: Dual Technology type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

2.6 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 6. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; 40595.

2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

2.8 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Modular, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Ivory or As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION

SECTION 16145

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor occupancy and switchbox-mounted occupancy sensors.

B. Related Requirements:

1. Section 16140 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lutron Electronics Co., Inc.
2. Sensor Switch, Inc.
3. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 3/4-inch knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lutron Electronics Co., Inc.
2. Sensor Switch, Inc.
3. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

C. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

D. Wiring Method: Comply with Section 16120 "Conductors and Cables." Minimum conduit size is 3/4 inch.

E. Identify components and power and control wiring according to Section 16075 "Electrical Identification."

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 16289

TRANSIENT VOLTAGE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranties: Sample of special warranties.

C. Short Circuit Current Rating (SCCR)

D. Voltage Protection Ratings (VPRs) for all modes

E. Maximum Continuous Operating Voltage rating (MCOV)

F. I-nominal rating (I-n)

G. Type 1 Device Listing

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

C. Comply with NEMA LS 1.

D. Comply with UL 1283 and UL 1449 3rd Edition.

E. Comply with NFPA 70 Article 285.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies Inc. (APT).
2. LEA International.
3. Surge Suppression Incorporated.
4. PDQ

B. Surge Protection Devices:

1. Non-modular.
2. LED indicator lights for power and protection status.
3. Comply with UL 1449 3rd Edition.
4. Fuses, rated at 200-kA interrupting capacity.
5. Fabrication using bolted compression lugs for internal wiring.
6. Integral disconnect switch.
7. Redundant suppression circuits.
8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.

C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.
3. Neutral to Ground: 50,000 A.

E. Protection modes and UL 1449 Listed Voltage Protection Ratings (VPRs) for grounded wye circuits with 480Y/277 V and 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 1200 V for 480Y/277 V and 800 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 800 V for 208Y/120 V.
3. Line to Line: 1800 V for 480Y/277 V and 1200 V for 208Y/120 V.
4. Neutral to Ground: 1200 V for 480Y/277 V and 800V for 208Y/120 V.

F. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV)

1. For 480Y/277 V 320V (15% Allowable System Voltage Fluctuations)
2. For 208Y/120 V 150V (25% Allowable System Voltage Fluctuations)

2.2 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, 30A or 60-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup checks according to manufacturer's written instructions.

B. TVSS device will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect service entrance equipment to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. 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.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.-ONLY

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers

G. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric-ONLY

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric-ONLY

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 16 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 16511

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior & Exterior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

G. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

H. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."

1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat-Removal Units: Air path leads through lamp cavity.
3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low-Temperature Environments: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature with indicated lamp types.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F.
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.7 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life 20,000 hours unless otherwise indicated.

B. T5 rapid-start lamps, rated 32 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.

1. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
2. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
3. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.8 HID LAMPS

A. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

B. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 16717

COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. Equipment Frames/Racks
3. UTP cabling.
4. Optical fiber cabling.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cabling identification products.
8. Cabling administration system

1.2 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Submittals, Cabling Administration Details, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. 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.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

E. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 6 Section "Rough Carpentry" for plywood backing panels.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Chatsworth Products, Inc. -ONLY

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.
2. Baked-polyester powder coat finish.

D. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. Mohawk; a division of Belden CDT.
4. Superior Essex Inc.
5. 3M.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, complying with UL 1666.

2.5 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Leviton Voice & Data Division-ONLY

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Corning Cable Systems.
5. Mohawk; a division of Belden Networking, Inc.
6. Superior Essex Inc.

B. Description: Multimode, 62.5/125-micrometer, 12-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA-492AAAB for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
b. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.

5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.7 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Berk-Tek; a Nexans company.
3. Corning Cable Systems.
4. Siemon Co. (The).

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages

2.8 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 16 Section "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.9 GROUNDING

A. Comply with requirements in Division 16 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 16 Section "Electrical Identification."

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 16 Section "Raceways and Boxes."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks. Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 16 Section "Raceways and Boxes" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

1. Administration Class: 1.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.
2) Length (physical vs. electrical, and length requirements).
3) Insertion loss.
4) Near-end crosstalk (NEXT) loss.
5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).
7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

   a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
   b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION

SECTION 16721

DIGITAL, ADDRESSABLE FIRE-ALARM & MASS NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Addressable interface device.
7. Digital alarm communicator transmitter.
8. Mass Notification System

1.2 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

a. Frequency of testing of installed components.
b. Frequency of inspection of installed components.
c. Requirements and recommendations related to results of maintenance.
d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide product by:

1. Fire Lite Alarms; a Honeywell company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
5. Activate emergency shutoffs for gas and fuel supplies.
6. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.

6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

a. Initiating Device Circuits: Style E.
b. Notification Appliance Circuits: Style Z.
c. Signaling Line Circuits: Style 4.
d. Install no more than 110 addressable devices on each signaling line circuit.

D. Notification Appliance Circuit: Operation shall sound in a ANSI S3.41 Temporal 3.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type. With integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Zone of the supervisory signal.
3. Zone of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.9 MASS NOTIFICATION SYSTEM

A. SPECIAL NOTE: THE MASS NOTIFICATION SYSTEM IS TO WORK IN CONJUNCTION WITH THE LOCAL BUILDING FIRE ALARM CONTROL PANEL/SYSTEM AS WELL AS WITH THE CENTRALIZED CAMPUS WIDE NETWORKED MASS NOTICATION SYSTEM WHETEHER EXISTING OR TO BE INSTALLED AT A FUTURE DATE.

B. Manufacturers:

1. EVAX SYSTEMS-ONLY.

2.10 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
4. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.11 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

2.12 PREAMPLIFIERS

A. Preamplifier: Integral to power amplifier.

B. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

C. Total Harmonic Distortion: Less than 1 percent.

D. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

E. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

F. Minimum Noise Level: Minus 55 dB below rated output.

G. Controls: On-off, input levels, and master gain.

2.13 POWER AMPLIFIERS

A. Mounting: Cabinet

B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.

C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

D. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

E. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.14 MICROPHONES

A. Paging Microphone:

1. Type: Dynamic, with cardioid polar characteristic.
2. Impedance: 150 ohms.
3. Frequency Response: Uniform, 50 to 14,000 Hz.
4. Output Level: Minus 58 dB, minimum.
5. Finish: Satin chrome.
6. Cable: C25J.
7. Mounting: Desk stand with integral-locking, press-to-talk switch.

2.15 CONTROL CABINET

A. Cabinet: Modular; complying with TIA/EIA-310-D.

B. Controls:

1. Switching devices to select signal sources for distribution channels.
2. Program selector switch to select source for each program channel.
3. Switching devices to select zones for paging.
4. All-call selector switch.

C. Indicators: A visual annunciation for each distribution channel to indicate source being used.

D. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.

E. Spare Positions: 20 percent spare zone control and annunciation positions on console.

F. Microphone jack.

2.16 SPEAKERS

A. To be integrated with fire alarm Horn/speaker devices:

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

G. Audible Alarm-Indicating Devices: Install not more than 80 inches above finished floor. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm horn no higher than 80 inches above finished floor

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION