MISSOURI

HIGHWAYS and TRANSPORTATION

COMMISSION

JEFFERSON CITY, MISSOURI

SPECIFICATIONS

FOR

CONSTRUCTING OR IMPROVING

Central Office
Warehouse Renovation Phase II
Jefferson City, Missouri

9-100217

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Shafer, Kline & Warren, Inc. SPECIFICATIONS
Annual Wage Order # 16
Plans & Drawings

BIDDER CHECKLIST

FINAL CHECKLIST BEFORE SUBMITTING PROPOSAL

_____1. The orange bound Request for Proposal includes a complete set of bidding forms, specifications, and appendices which are made part of the proposal by reference. It is for the bidders information and convenience only and is not to be returned with the proposal.

_____2. The blue bound Proposal contains a complete set of bidding forms only. It is to be completed, executed and submitted in a sealed envelope marked " Warehouse Renovation Phase II"

_____ a. Complete the Bid Form by filling in the total dollar amount of the bid; listing any addenda which may have been issued; filling in the dollar amount of the bidder's check or Bid Bond, sign the proper signature line, and supply the required information in connection with the signature for the individual bidder, joint adventurer, or corporation.

_____ b. Submit Bid Bond executed by the bidder and surety. The bidder may use the Bid Bond furnished by the Commission or AIA Document A310 or approved equivalent or attach cashier's check to Bid Bond form. Personal checks are not accepted.

_____ c. Complete Subcontractor section by listing major subcontractor(s) and general supervisor(s), sign as required.

_____ d. Complete Certification Regarding Missouri Domestic Products Procurement Act section, if applicable.

_____3. If addenda are issued attach to the back of the blue bound Proposal. Copy addenda and add to the appropriate section of the orange bound Request for Proposal and retain for your records.

NEWSPAPER ADVERTISEMENT

Notice to Contractors

MoDOT will receive bids for its Warehouse Renovation Phase II project at its One Stop Office, General Services, 1320 Creek Trail Dr., Jefferson City, MO until 3:00 p.m. on February 17, 2010. Bidders may secure copies of the forms, specifications, and information from the MoDOT General Services Facilities Office Located at 1320 Creek Trail Dr., Jefferson City beginning January 19, 2010. A nonrefundable sum of $50 will be charged for each set of bid documents. Contact Lynn Ferguson at 573-751-4879 or Lynn.Ferguson@modot.mo.gov to for plans, forms, and information, or download them at no charge at http://modot.org/business/contractor_resources/FacilitiesConstructionandMaintenance.htm. Prevailing wages as established by the Missouri Department of Labor and Industrial Relations, for Cole County will apply. A mandatory pre-bid conference is scheduled for January 27, 2010, at the Central Office Warehouse Conference Room, upstairs, east entrance next to the mechanics bays located at 830 MoDOT Drive, Jefferson City, MO, at 10:00 A.M.

INVITATION TO BID

Notice is given hereby that the Missouri Department of Transportation will accept bids for construction of the proposal marked "Proposal for Central Office Warehouse Renovation Phase II, Jefferson City, Missouri ", according to Drawings and Specifications, and described in general as:

Warehouse Renovation Phase II

Sealed bids will be received by the Missouri Department of Transportation at its Central Office, Creek Trail Drive, PO Box 270, Jefferson City, MO 65102-0270 until 3:00 P.M., February 17, 2010.

Bids will be opened and read aloud at that time and that place. Bids received after that time will not be accepted.

Bidders may secure copies of the Proposal, contract forms, specifications, plans and information from the MoDOT General Services Procurement Office Located at 1320 Creek Trail Drive, Jefferson City, MO beginning January 19, 2010. A sum of $50 will be charged for each set of bid documents which shall be non-refundable.

Prevailing wages as established by the Missouri Department of Labor and Industrial Relations, for Cole County, as shown in the Proposal, will apply.

Bid securities in the amount of 5% of the bid will be required to accompany bids.

Proposals must be made on forms provided by the Commission. The Commission reserves the right to reject any or all bids and to waive irregularity in the bids and the bidding. No bid may be amended or withdrawn after the bid is opened.

A mandatory pre-bid conference is scheduled for January 27, 2010, at the Central Office Warehouse Conference Room, upstairs, east entrance next to the mechanics bays located at 830 MoDOT Drive, Jefferson City, MO, at 10:00 A.M.

MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION

_____

Building Design Supervisor

SECTION 00100
INSTRUCTIONS TO BIDDER

1. SCOPE OF WORK

Central Office Warehouse Renovation Phase II, Jefferson City, Missouri

2. BID FORM

In order to receive consideration, bids must be made in strict accordance with the following.

A. Make bids, upon the forms provided herein, properly signed and with all items filled out. Do not change the wording of the bid form and do not add words to the bid form. Unauthorized conditions, limitations or provisions attached to the bid will be cause for rejection of the bid.

B. No telegraphic bid or telegraphic modification of a bid will be considered. No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the bidder unopened.

C. Address bids to the Missouri Department of Transportation, and deliver to the address given in the Invitation to Bid, on or before the day and hour set for opening the bids. Enclose each bid in a sealed envelope bearing the title of the Work, the name of the bidder, and the date and hour of the bid opening. Submit only the original signed copy of the bid. It is the sole responsibility of the bidder to see that the bid is received on time.

3. BONDS

A. Bid securities, a cashiers check, a Bank Money Order, or a Certified Check made payable to "Director of Revenue, Credit Road Fund", in the amount stated in the invitation to bid must accompany each bid. The successful bidder's security will be retained until he has signed the Contract and has furnished the required Certificates of Insurance.

B. The Owner reserves the right to retain the security of all bidders until the successful bidder enters into the Contract. Other bid securities will be returned as soon as practical. If any bidder refuses to enter into a Contract, the Owner may retain his bid security as liquidated damages but not as a penalty.

C. Prior to signing the Contract, the successful bidder will secure a Performance Bond in the amount of 100% of the Contract Sum. Surety, acceptable to the Owner, shall issue the bond. Costs of such bonds will be the responsibility of the bidder.

4. EXAMINATION OF DOCUMENTS AND SITE OF WORK

Before submitting a bid, each bidder shall examine the Drawings carefully, read the Specifications and all other proposed Contract Documents, and visit the site of the work. Each bidder shall fully inform himself, prior to bidding, as to existing conditions and limitations under which the Work is to be performed and shall include in his bid a sum to cover the cost of items necessary to perform the Work, as set forth in the proposed Contract Documents. No allowance will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered conclusive evidence that the bidder has made such examination.

5. INTERPRETATION

No oral interpretations will be made to any bidder as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than ten (10) calendar days before opening of bids. The request shall be sent directly to the project Designer. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.

6. PROOF OF COMPETENCY OF BIDDER

A bidder may be required to furnish evidence, satisfactory to the Commission, that he and his proposed subcontractor(s) have sufficient means and experience in the types of work called for to assure completion of the Contract in a satisfactory manner.

7. WITHDRAWAL OF BIDS

A. A bidder may withdraw his bid, either personally or by written request, at any time prior to the scheduled time for opening bids.
B. No bid may be amended or withdrawn after the bid is opened.

8. AWARD OR REJECTION OF BIDS

A. The Contract, if awarded, will be awarded to the responsible bidder who has proposed the lowest Contract Sum, subject to the Commission's right to reject any or all bids and to waive informality and irregularity in the bids and in the bidding.
B. Award of alternates, if any, will be made in numerical order to result in the maximum amount of work being accepted within available construction funds.
C. MoDOT is exempt from paying Missouri Sales Tax, Missouri Use Tax and Federal Excise Tax. An Exemption From Missouri Sales and Use Tax on Purchases letter and a Project Exemption Certificate (Form 5060 Rev. 10-2006) for tax-exempt purchases at retail of tangible personal property and materials for the purpose of constructing, repairing or remodeling facilities for the Missouri Highways and Transportation Commission, only if such purchases will "are related to the Commission's exempt functions and activities be furnished to the successful Bidder upon request.

9. EXECUTION OF CONTRACT

A. The Contract, which the successful bidder will be required to execute, will be included in the Contract Documents.
B. The bidder to whom the Contract is awarded shall, within fourteen calendar days after notice of award and receipt of Contract Documents from the Commission, sign and deliver required copies to the Commission.
C. Upon delivery of the signed Contract, the bidder to whom the Contract is awarded shall deliver to the Commission those Certificates of Insurance required by the Contract Documents and Performance Bond, as required by the Commission.
D. Execution of the Contract by the Commission must be done before the successful bidder may proceed with the work.

10. CONSTRUCTION TIME AND LIQUIDATED DAMAGES

A. Time of Completion - If this proposal is accepted, it is hereby agreed that work will begin not later than the date specified in the "Notice to Proceed" and will diligently be prosecuted in order to complete the entire project and billing by **August 9, 2010**. Completion of work will be based on FINAL ACCEPTANCE of the building; "SUBSTANTIAL COMPLETION" will not be accepted as basis for completion.

B. Liquidated Damages - It is agreed that time is of the essence. Because failure to complete the contract within the time fixed herein will cause serious inconvenience, loss, and damage to the state, liquidated damages will be assessed in the amount of $1,000 per day, for each calendar day after the agreed completion date that the work is not fully completed.

11. NONDISCRIMINATION

A. The Bidder/Offeror understands that this project involves state funds and the Bidder/Offeror awarded the contract will be required to comply with the Executive Order 05-30 of the Governor of the State of Missouri dated September 8, 2005. This order stipulates that there shall be no discriminatory employment practices by the Contractor or his subcontractors, if any, based on race, sex, religion, national origin, age, color, disability, or veteran status. The undersigned Contractor or his subcontractors, if any, shall give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor shall comply with the Regulations relative to nondiscrimination in federally-assisted programs of the Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

C. All solicitations either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials or leases of the Contractor's obligations under this contract and the Regulations, will be relative to nondiscrimination on the grounds of race, color, or national origin.

D. Sanctions for Noncompliance: In the event of the Contractor's noncompliance with the nondiscrimination provisions of this contract, MoDOT shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to: (i) withholding of payments to the Contractor under the contract until the Contractor complies, and/or, (ii) cancellation, termination or suspension of the contract, in whole or in part.

12. EXECUTIVE ORDER

A. The Contractor shall comply with all the provisions of Executive Order 07-13, issued by the Honorable Matt Blunt, Governor of Missouri, on the sixth (6th) day of March, 2007. This Executive Order, which promulgates the State of Missouri's position to not tolerate persons who contract with the state engaging in or supporting illegal activities of employing individuals who are not eligible to work in the United States, is incorporated herein by reference and made a part of this Agreement.

B. "By signing this Agreement, the Contractor hereby certifies that any employee of the Contractor assigned to perform services under the contract is eligible and authorized to work in the United States in compliance with federal law."

C. In the event the Contractor fails to comply with the provisions of the Executive Order 07-13, or in the event the Commission has reasonable cause to believe that the contractor has knowingly employed individuals who are not eligible to work in the United States in violation of federal law, the Commission reserves the right to impose such contract sanctions as it may determine to be appropriate, including but not limited to contract cancellation, termination or suspension in whole or in part or both.

D. The Contractor shall include the provisions of this paragraph in every subcontract. The Contractor shall take such action with respect to any subcontract as the Commission may direct as a means of enforcing such provisions, including sanctions for noncompliance.

13. Missouri law, 292.675 RSMo, requires the Contractor and its subcontractor(s) to provide a ten-hour occupational safety and health administration (OSHA) construction safety program (or a similar program approved by the Missouri Department of Labor and Industrial Relations as a qualified substitute) for their on-site employees (laborers, workmen, drivers, equipment operators, and craftsmen) who have not previously completed such a program and are directly engaged in actual construction of the improvement (or working at a nearby or adjacent facility used for construction of the improvement). The Contractor and its subcontractor(s) shall require all such employees to complete this ten-hour program, pursuant to 292.675 RSMo, unless they hold documentation on their prior completion of said program. Penalties for non-compliance include Contractor forfeiture to the Commission in the amount of $2,500, plus $100 per contractor and subcontractor employee for each calendar day such employee is employed beyond the elapsed time period for required program completion under 292.675 RSMo.

14. EMPLOYMENT OF UNAUTHORIZED ALIENS

A. Pursuant to 285.530 RSMo, the bidder/offeror must affirm its enrollment and participation in a federal work authorization program with respect to the employees proposed to work in connection with the services requested herein by

- submitting a completed, notarized copy of the AFFIDAVIT OF WORK AUTHORIZATION and
- providing documentation affirming the bidder's/offeror's enrollment and participation in a federal work authorization program (see below) with respect to the employees proposed to work in connection with the services requested herein.

B. E-Verify is an example of a federal work authorization program. Acceptable enrollment and participation documentation consists of completed copy of the E-Verify Memorandum of Understanding (MOU). For vendors that are not already enrolled and participating in a federal work authorization program, E-Verify is available at http://www.dhs.gov/xprevprot/programs/gc_1185221678150.shtm.

C. The contractor understands and agrees that by signing the (IFB/RFP/RFQ/SFS document or contract), they certify the following:

a. The contractor shall only utilize personnel authorized to work in the United States in accordance with applicable federal and state laws. This includes but is not limited to the Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) and INA Section 274A.

b. If the contractor is found to be in violation of this requirement or the applicable state, federal and local laws and regulations, and if the State of Missouri has reasonable cause to believe that the contractor has knowingly employed individuals who are not eligible to work in the United States, the state shall have the right to cancel the contract immediately without penalty or recourse and suspend or debar the contractor from doing business with the state.

c. The contractor agrees to fully cooperate with any audit or investigation from federal, state or local law enforcement agencies.

d. In addition, the contractor shall maintain enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services included herein.

15. PREFERENCES

A. In the evaluation of bids/quotes/proposals, preferences shall be applied in accordance with Chapter 34 RSMo. Contractors should apply the same preferences in selecting subcontractors.

B. By virtue of statutory authority, RSMo. 34.076 and 34.350 to 34.359, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, made or grown within the State of Missouri. Such preference shall be given when quality is equal or better and delivered price is the same or less.

1) If attached, the document entitled "PREFERENCE IN PURCHASING PRODUCTS" should be completed and returned with the solicitation documents.

2) If attached, the document entitled "MISSOURI DOMESTIC PRODUCTS PROCUREMENT ACT" should be completed and returned with the solicitation documents. Applies if bid is Twenty-Five Thousand Dollars ($25,000.00) or more.

C. By virtue of statutory authority, RSMo 34.074, a preference will be given all contracts for the performance of any job or service to service-disabled veteran business either doing business as Missouri firms, corporations, or individuals; or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less or whenever competing bids, in their entirety, are comparable.

1) If attached, the document entitled "MISSOURI SERVICE-DISABLED VETERAN PREFERENCE" should be completed and returned with the solicitation documents.

D. In the event of a tie of low bids, the MHTC reserves the right to establish the method to be used in determining the award.

PREFERENCES IN PURCHASING PRODUCTS

DATE: _____

The bidders attention is directed to Section 34.076 RSMo 2000 which gives preference to Missouri corporations, firms, and individuals when letting contracts or purchasing products.

Bids/Quotations received will be evaluated on the basis of this legislation.

All vendors submitting a bid/quotation must furnish ALL information requested below.

FOR CORPORATIONS:

State in which incorporated: _____

FOR OTHERS:

State of domicile: _____

FOR ALL VENDORS:

List address of Missouri offices or places of business:

_____

_____

_____

_____

_____

_____

_____

THIS SECTION MUST BE COMPLETED AND SIGNED:

FIRM NAME: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

BY (signature required): _____

Federal Tax I.D. #: _____ if no Federal Tax I.D. # - list Social Security #: _____

NOTE: For bid/quotation to be considered, the "Preference in Purchasing Products" form must be on file in the General Services (Procurement) Division and must be dated in the current calendar year.

MISSOURI DOMESTIC PRODUCTS PROCUREMENT ACT

The bidder's attention is directed to the Missouri Domestic Products Procurement Act, Sections 34.350 to 34/359, RsMO, which requires all manufactured goods or commodities used or supplied in the performance of this contract or any subcontract to be manufactured or produced in the United States.

Section 34.355, RsMO, requires the vendor or contractor to certify his compliance with Section 34.353 and, if applicable, Section 34.359, RsMO, at the time of bidding and prior to payment. Failure to comply with Section 34.353, RsMO, during the performance of the contract and to provide certification of compliance prior to payment will result in nonpayment for those goods or commodities.

Section 34.353.2, RsMO, specifies that it does not apply where the total contract is less than Twenty-Five Thousand Dollars ($25,000.00). If your total bid is Twenty-Five Thousand Dollars ($25,000.00) or more, you must complete this form as directed below.

Failure to complete and return this document with this bid will cause the State to presume the manufactured goods or products listed in the bid are not manufactured or produced in the United States, and the bid will be evaluated on that basis. Please read the certification appearing below on this form.

[ ] If all the goods or products specified in the attached bid which the bidder proposes to supply to the State shall be manufactured or produced in the "United States" as defined in Section 34.350, RsMO, check the box at left.

[ ] If only one item of any particular goods or products specified in the attached bid is manufactured or produced in the "United States" as defined in Section 34.350, RsMO, check the box at left and list the items (or item number) here:

_____

_____

[ ] If any or all of the goods or products specified in the attached bid which the bidder proposes to supply to the State are not manufactured or produced in the "United States" as defined in Section 34.350, RsMO, then: (a) check the box at left; (b) list below, by item (or item number), the country other than the United States where each good or product is manufactured or produced; and (c) check the boxes to the left of the paragraphs below if applicable and list the corresponding items (or item numbers) in the spaces provided.

Item (or item number)	Location Where Item Manufactured or Produced

(attach an additional sheet if necessary)

[ ] The following specified goods or products cannot be manufactured or produced in the United States in sufficient quantities or in time to me the contract specifications. Items (or item numbers): _____

_____

[ ] The following specified goods or products must be treated as manufactured or produced in the United States, in accordance with an existing treaty, law, agreement, or regulation of the United States, including a treaty between the United States and any foreign country regarding export-import restrictions or international trade. Items (or item numbers): _____

_____

CERTIFICATION

By submitting this document, completed as directed above, with a bid, the bidder certifies under penalty of making false declaration (Section 575.060, RsMO) that the information contained in this document if true, correct and complete, and may be relied upon by the State in determining the bidders qualifications under and in compliance with the Missouri Domestic Products Procurement Act.

The bidder's failure to complete and return this document with the bid as directed above will cause the State to presume the manufactured goods or products listed in the bid are not manufactured or produced in the United States, and the bid will be evaluated on that basis pursuant to Section 34.353.3(2), RsMO.

MISSOURI SERVICE-DISABLED VETERAN BUSINESS PREFERENCE

By virtue of statutory authority, RSMo 34.074, a preference will be given all contracts for the performance of any job or service to service-disabled veteran business either doing business as Missouri firms, corporations, or individuals; or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less or whenever competing bids, in their entirety, are comparable.

Definitions:

Service-Disabled Veteran is defined as any individual who is disabled as certified by the appropriate federal agency responsible for the administration of veterans' affairs.

Service-Disabled Veteran Business is defined as a business concern:

a. Not less than fifty-one (51) percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than fifty-one (51) percent of the stock of which is owned by one or more service-disabled veterans; and
b. The management and daily business operations of which are controlled by one or more service-disabled veterans.

If an offeror meets the definitions of a service-disabled veteran and a service-disabled veteran business as defined in 34.074 RSMo and is either doing business as a Missouri firm, corporation, or individual; or maintains a Missouri office or place of business, the offeror must provide the following with the proposal in order to receive the Missouri service-disabled veteran business preference over a non-Missouri service-disabled veteran business when the quality of performance promised is equal or better and the price quoted is the same or less or whenever competing proposals, in their entirety, are comparable:

a. A copy of a letter from the Department of Veterans Affairs (VA), or a copy of the offeror's discharge paper (DD Form 214, Certificate of Release or Discharge from Active Duty) from the branch of service the offeror was in, stating that the offeror has a service-connected disability rating ranging from 0 to 100% disability; and
b. A completed copy of this exhibit

(NOTE: For ease of evaluation, please attach copy of the above-referenced letter from the VA or a copy of the offeror's discharge paper to this Exhibit.)

By signing below, I certify that I meet the definitions of a service-disabled veteran and a service-disabled veteran business as defined in 34.074 RSMo and that I am either doing business as a Missouri firm, corporation, or individual; or maintain Missouri offices or places of business at the location(s) listed below.

Veteran Information	Business Information
Service-Disabled Veteran's Name, (Please Print)	Service-Disabled Veteran Business Name
Service-Disabled Veteran's Signature	Missouri Address of Service-Disabled Veteran Business

SECTION 00301

BID FORM

To: The Missouri Highway and Transportation Commission
105 West Capitol Avenue
Jefferson City, Missouri 65101

1. The undersigned, having examined the proposed Contract Documents titled: **"CO Warehouse Renovation Phase II"** and having visited the site and examined the conditions affecting the Work, hereby proposes and agrees to furnish all labor, materials, equipment and everything which may be necessary or incidental thereto, as proposed by said Contract Documents, all to the satisfaction of the Chief Engineer of the Missouri Department of Transportation and the Missouri Highway and Transportation Commission, for the stipulated sum of:

_____ DOLLARS ($_____).

2. The undersigned, acknowledges having examined and being familiar with the contract documents including the drawings, the Instructions to Bidders, General Conditions, Supplementary Conditions and the body of technical specifications.

3. The undersigned acknowledges receipt of Addenda number _____ through _____ inclusive.

4. Enclosed with this bid is bid security in the amount of not less than 5% of the bidder's proposed Contract Sum, the amount being _____ DOLLARS ($_____).

IF AN INDIVIDUAL

_____

_____ _____
Name of individual Residence address

_____ _____
Social Security Number Telephone Number

_____
Firm Name, If Any

_____

_____ _____
Address for communications Signature

IF A PARTNERSHIP

_____
Name of Partnership

_____
Partner

_____
Partner

_____

_____
Address for Communications

_____
Telephone Number

(State Name and Residence Address of All Partners)

_____

_____
Residence Address

_____

_____
Residence Address

_____
Federal Tax I.D. Number

_____
Signature of Either Partner

IF A CORPORATION

_____
Name of Corporation

_____
Name and Title of Officer

_____
Signature of officer

_____

_____
Address for Communications

_____
Telephone Number

Incorporated under the laws of the
State of_____

Corporate License No. _____
(If a corporation organized in a state other than Missouri, attach Certificate of Authority to do business in the State of Missouri.)

_____
Federal Tax I.D. Number

(ATTEST)

_____
(SEAL) Secretary

(Each bidder must complete the Bid Form by signing in the proper signature line above and by supplying the required information called for in connection with the signature. The information called for is necessary in the proper preparation of the contract and performance bond.)

SECTION 00430

SUBCONTRACTOR LISTING

1. For portions of Work equaling or exceeding 1% of the total proposed Contract Sum, the undersigned proposes to use the following subcontractors. Except as otherwise approved by the Owner, the undersigned proposes to perform all other portions of the Work with his own forces.

2. Portion of the Work: Subcontractor name and address:

_____ _____

_____

_____

_____ _____

_____

_____

_____ _____

_____

_____

_____ _____

_____

_____

_____ _____

_____

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_____ _____

_____

_____

_____	_____ _____ _____
_____	_____ _____ _____
_____	_____ _____ _____
_____	_____ _____ _____
_____	_____ _____ _____

USE ADDITIONAL SHEETS IF REQUIRED

PROVIDE SIGNATURE IDENTICAL TO THAT SHOWN ON THE BID FORM

BIDDER:

_____

by_____

SECTION 00600

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____, as Principal, and _____ , as Surety, are held firmly bound unto the State of Missouri (acting by and through the Missouri Highway and Transportation Commission) in the penal sum of _____ Dollars ($_____), to be paid to the State of Missouri, or the Missouri Highway and Transportation Commission, to be credited to the State Road Fund and Principal and Surety binding themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Sealed with our seals and dated this _____ day of _____, 20_____

THE CONDITION OF THIS OBLIGATION is such that:
WHEREAS, the Principal is submitting herewith a bid to the Missouri Highway and Transportation Commission on

Route(s) _____,

in _____ County(ies), Project(s) _____,

for construction or improvement as set out in said proposal.

NOW THEREFORE, if the Missouri Highway and Transportation Commission shall accept the bid of the Principal, and if said Principal shall properly execute and deliver to the Missouri Highway and Transportation Commission the Contract, Contract Bond, Specifications and evidence of insurance coverage in compliance with the requirements of the Proposal, to the satisfaction of the Missouri Highway and Transportation Commission, then this obligation shall be void and of no effect, otherwise to remain in full force and effect.

In the event the said Principal shall, in the judgment of the Missouri Highway and Transportation Commission, fail to comply with any requirement as set forth in the preceding paragraph, then the State of Missouri, acting through the Missouri Highway and Transportation Commission, shall immediately and forthwith be entitled to recover the fees, and any other expense of recovery.

_____ Principal

_____ Surety

By_____

_____ Attorney in Fact (SEAL)

Attest: (CORPORATE SEAL)

_____ Corporate Secretary

Note: This bond must be executed by the Principal and by a Corporate Surety authorized to conduct surety business in the State of Missouri.

SECTION 01010

GENERAL CONDITIONS

1. General. The contractor shall do all things necessary to the performance of the contract in a substantial and acceptable manner in accordance with the specifications and plans.

2. Employer's Liability. Contractor shall furnish evidence to the Commission that with respect to the operations it performs, it either carries employers' liability or worker's compensation insurance or is qualified as self-insured under the provisions of law of the state relating to worker's compensation.

3. The Contractor shall purchase and maintain such insurance as will protect him from claims under workmen's compensation acts and other employee benefit acts, from claims for damages because of bodily injury, including death, and from claims for damages to property which may arise out of or result from the Contractor's operations under this Contract, whether such operations be by himself or by any Subcontractor or anyone directly or indirectly employed by any of them.

4. This insurance shall be written for not less than any limits of liability specified as part of this contract, or required by law, whichever is the greater, and shall include contractual liability insurance as applicable to the Contractor's obligations under this contract. Unless otherwise specified, insurance limits shall be as follows:

   A. Workmen's Compensation: Workers Compensation Insurance, including "Occupational Disease Act" requirements, must be maintained if required by law.

   B. Public Liability (includes property damage and personal injury):

      i Not less than $500,000 for any one person in a single accident or occurrence.

      ii. Not less than $3,000,000 for all claims arising out of a single occurrence.

5. Duration of Insurance. The evidence of insurance required by sections 2, 3, and 4 above shall be furnished to the Commission prior to the effective date of the Notice to Proceed. All insurance herein before specified shall be carried until all work required to be performed under the terms of the contract is satisfactorily completed as evidenced by the formal acceptance by the Commission and in the event that the limits of coverage for property damage are depleted or decreased by the payment of claims, the contractor shall procure a reinstatement of the limits. The cost of all insurance required to be carried by the contractor shall be considered as completely covered by the contract price.

6. Inspection of Work. Commission's engineer shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other data and records relating to the work. If requested by Commission's engineer, the contractor shall at any time before final acceptance of the work uncovers any portion of the finished work as directed for inspection. After examination, the contractor shall restore said portions of the work to the standards required by the contract. Should the work thus exposed and examined prove acceptable, the actual cost of uncovering, removing and replacing shall be paid by the Commission. Should the work so exposed and examined prove unacceptable, the uncovering, removing and replacing shall be at the expense of the contractor.

7. Change Orders. All departures from the plans and specifications will be considered unauthorized unless, before proceeding with the work, the contractor has had delivered to it a change order, signed by the Commission's engineer, authorizing and directing such changes or departures. All unauthorized work shall be at the contractor's expense and the engineer may order such unauthorized work removed and replaced at the contractor's expense.

8. Defective Work. All work which has been rejected shall be remedied, or if necessary, removed and replaced in an acceptable manner by the contractor at its expense. If the contractor fails to remedy or replace such defective work immediately after receiving written notice from the Commission's engineer, Commission may employ labor to correct the defective work, and the cost incurred in making such corrections shall be deducted from the payment due or to become due the contractor under this contract.

9. Contractor's Responsibility for Work. Until Commission's engineer accepts the work, it shall be in the custody and under the charge and care of the contractor. Contractor shall rebuild, repair, restore or make good at its own expense any lost or stolen Commission-owned material and all injuries or damages to any portion of the work caused by action of the elements or from any other reason before its completion and final acceptance. Issuance of a payment estimate on any part of the work done will not be considered as final acceptance of any work completed up to that time.

10. Preservation of Utilities and Monuments. The contractor shall be responsible for the preservation of all public and private utilities, wires, lines, pipes, poles, cables, and conduit at the site of the work and shall use every precaution necessary to prevent damage or injury thereto. The contractor shall not disturb or damage any land monument or property landmark until an authorized agent has witnessed or otherwise referenced, their location and shall not remove them until directed by Commission's engineer.

11. Cooperation with Other Contractors. The contractor shall arrange its work so as not to interfere with the operations of other contractors of the Commission which might be engaged in performing adjacent or nearby work. Whenever work being done by other contractors is contiguous or related to the work involved in this contract, the respective rights of the various contractors will be determined by the Commission's engineer in order to secure the completion of the work under all contracts in general harmony.

12. Temporary Suspension of Work. Commission's engineer shall have authority to suspend work, wholly orin part, for such period or periods of time as he may deem necessary when weather or other conditions are such that in the opinion of the engineer the work may be done at a later time with advantage to the Commission or for failure on the part of the contractor to comply with any of the provisions of the contract. The contractor may suspend work for reasonable cause with written approval of the engineer. Liquidated damages shall not accrue during the period in which work is suspended with the approval of the engineer, however, if the suspension is because of the contractor's failure to comply to any of the provisions of the contract, the contractor shall not be entitled to an extension of completion time nor to a waiver of liquidated damages. In the event work is suspended, the contractor shall store all materials in a manner that will protect them from damage, and shall take every precaution to prevent damage or deterioration of, the portions of the work completed. If work has been discontinued for any reason, the contractor shall give Commission's engineer written notice at least forty-eight (48) hours before resuming operations.

13. Contractor's Procedure for Claims. If the contractor considers additional compensation may be due for work or material not clearly covered in the contract or ordered in writing by the engineer as extra work, or if additional compensation may be requested beyond the scope of such provisions, the contractor shall notify the engineer in writing of the intention to make a claim before beginning the work in question. If notification is not given and the engineer is not afforded proper facilities by contractor to provide necessary inspection and for keeping strict account of actual cost, the contractor agrees to waive any claims for additional compensation. Notice by the contractor, and the fact that the engineer has kept account of the cost shall not be construed as substantiating the validity of the claim. The contractor shall file a written notice of claim for additional compensation in triplicate within 60 days after completing the work in question.

    If the claim is against the Commission, the notice of claim shall be personally delivered, or sent by certified mail to the office of the Secretary of the Commission in Jefferson City, Missouri. All notices of claims shall contain an itemized statement showing completely and fully the items and amounts forming the basis of the claim.

    Any claim or an item of any claim, not included in the notice and statement, or any claim included but not clearly defined and specifically set out and itemized or any claim not filed within the time and in the manner provided, shall be forever waived and shall neither constitute the basis of nor be included in any legal action, counterclaim, set-off, or arbitration.

    All claims filed with Missouri Highway and Transportation Commission's Secretary will be forwarded to the Missouri Department of Transportation's Claims Committee.

14. Overhead and Profit on Change Orders. The percentages for overhead and profit charged on Change Orders and Field Work Authorizations shall be negotiated and may vary according to the nature, extent and complexity of the work involved. However, the overhead and profit for the contractor or subcontractor actually performing the work shall not exceed 15%. When one or more tiers of subcontractors are used, in no event shall any contractor or subcontractor receive as overhead and profit more than 7% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the owner on any change order exceed twenty five percent (25%) of the cost of materials, labor and equipment necessary to put the change order work in place.

15. Review of Submittals. The architect’s review of submittals is only for the limited purpose of checking for conformance with information given and seeing if they conform to design intent. The architect is not responsible for determining the accuracy of measurements and completeness of details, for verifying quantities, or for checking fabrication or installation procedures. The architect’s review does not relieve the contractor of his or her responsibilities under the contract documents.

16. A working day. Is defined as any day when, soil and weather conditions would permit the major operation of the project for six hours or more unless other unavoidable conditions prevent the contractor's operation. If conditions require the contractor to stop work in less than six hours, the day will not be counted as a working day. Working days will begin as soon as notice to proceed is issued. In order for MoDOT not to change a workday due to unavoidable conditions, the contractor must have enough forces, equipment, and materials on site to begin the project. The contractor must notify MoDOT inspector before 12:00 noon of said working day if forces will not be present.

END OF SECTION

SECTION 01011

SUPPLEMENTARY CONDITIONS

A. The following supplements modify, change, delete from or add to the "General Conditions."

1. The proposed work includes the furnishing of all materials, equipment and labor for the work as set forth in the plans, proposal and specifications.

2. The contractor will be required to remove from the Highway and Transportation Commission's property all debris.

3. The contract price shall include any necessary permits and licenses required by law incidental to the work. Local ordinances requiring building permits are not applicable to the state. Contractor will comply with local laws involving safety in the prosecution of the work.

4. Contractor will provide a one-year warranty for parts and labor on all building material, and equipment or a standard manufacturer's warranty which ever is greater. All warranties, including extended service agreements shall begin on the date of Final Acceptance of this project.

5. The plans holders list may be obtained from the One Stop Facility located at 1320 Creek Trail Dr., Jefferson City, Mo 65102 , by calling 573/751-4879 or electronically down-loaded from http://www.modot.org/business/contractor_resources/FacilitiesConstructionandMaintenance.htm

END OF SECTION

SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.
B. Application for payment.
C. Change procedures.
D. Alternatives.

1.2 RELATED SECTIONS

A. Section 01600 - Material and Equipment: Product substitutions.

1.3 SCHEDULE OF VALUES

A. Submit a printed schedule on Contractor's standard form. Electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 20 days after date of Owner-Contractor Agreement.

C. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PAYMENT

A. Submit four copies of each application on Contractor's electronic media driven form.
B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
C. Payment Period: 30 days.
D. Submit waiver of liens from vendors.
E. Include an updated construction progress schedule.
F. Certified payroll records.

1.5 CHANGE PROCEDURES

A. The Architect/Engineer may issue a Notice of Change that includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required.

B. The Contractor may propose changes by submitting a request for change to the Architect/Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, the effect on the Contract Sum/Price and Contract Time, and a statement describing the effect on Work by the MoDOT District or other Contractors.

C. Stipulated Sum/Price Change Order: Based on Notice of Change and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Architect/Engineer.

D. Construction Change Directive: Architect/Engineer may issue a directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

E. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Architect/Engineer will determine the change allowable in Contract Sum/Price and Contract Time as provided in the Contract Documents.

F. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

G. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specify requirements.
B. If, in the opinion of the Architect/Engineer, it is not practical to remove and replace the Work, the Architect/Engineer will direct an appropriate remedy or adjust payment.

1.7 ALTERNATIVES

A. Accepted Alternatives will be identified in Owner-Contractor Agreement.

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.
B. Field engineering.
C. Preconstruction meeting.
D. Site mobilization meeting.
E. Progress meetings.
F. Preinstallation meetings.
G. Equipment electrical characteristics and components.
H. Examination.
I. Preparation.
J. Cutting and Patching.
K. Alteration project procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to and placing in service, such equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, except as otherwise indicated, conceal pipes, ducts and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of Missouri and acceptable to Architect/Engineer.
B. Owner will locate and protect survey control and reference points.
C. Control datum for survey is that established by Owner provided survey.
D. Verify setbacks and easements; confirm drawing dimensions and elevations.
E. Provide field engineering services. Establish elevations, lines and levels, utilizing recognized engineering survey practices.

1.4 PRECONSTRUCTION MEETING

A. Architect/Engineer will schedule a meeting after Notice of Award.
B. Attendance Required: District engineer or representative, Architect/Engineer and Contractor.

C. Record minutes and distribute copies within 5 days after meeting to participants, with two copies to District Engineer, Architect/Engineer, participants and those affected by decisions made.

1.5 SITE MOBILIZATION MEETING

A. Architect/Engineer will schedule a meeting at the Project site prior to Contractor occupancy.

B. Architect/Engineer will record minutes and distributes copies within 5 days after meeting to participants, with two copies to Architect/Engineer, participants and those affected by decisions made.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at when arranged by architect/engineer.

B. Architect/Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, District engineer representative, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review of Work progress.
2. Field observations, problems, and decisions.
3. Identification of problems, which impede planned progress.
4. Maintenance of progress schedule.
5. Corrective measures to regain projected schedules.
6. Coordination of projected progress.
7. Effect of proposed changes on progress schedule and coordination.

E. Record minutes and distributes copies within 5 days after meeting to participants and those affected by decisions made.

1.7 PREINSTALLATION MEETING

A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.
B. Notify Architect/Engineer seven days in advance of meeting date.
C. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related work.
D. Record minutes and distributes copies within 5 days after meeting to participants and those affected by decisions made.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements, which affect:

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching to complete Work, and to:
1. Uncover Work to install or correct ill-timed Work.
2. Remove and replace defective and non-conforming Work.
3. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Cut masonry and concrete materials using masonry saw or core drill.

E. Fit Work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

H. Identify hazardous substances or conditions exposed during the Work to the Architect/Engineer for decision or remedy.

3.2 ALTERATION PROJECT PROCEDURES

A. Materials: As specified in Product sections; match existing Products and work for patching and extending work.

B. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

C. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Architect/Engineer for review.

D. Patch or replace portions of existing surfaces that are damaged, lifted, discolored or showing other imperfections.

E. Finish surfaces as specified in individual Product sections.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.
B. Construction progress schedules.
C. Proposed Products list.
D. Product Data.
E. Shop Drawings.
F. Samples.
G. Design data.
H. Test reports.
I. Certificates.
J. Manufacturer's instructions.
K. Manufacturer's field reports.
L. Erection drawings.
M. Construction photographs.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals
B. Section 01400 - Quality Control: Manufacturers' field services and reports.
C. Section 01700 - Contract Closeout: Contract warranties, bonds, manufacturers' certificates and closeout submittals.

1.3 REFERENCES

A. AGC Associated General Contractors of America publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry".

1.4 SUBMITTAL PROCEDURES

A. Transmit each submittal with Architect/Engineer accepted form.

B. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number and specification section number, as appropriate.

C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work and coordination of information is in accordance with the requirements of the Work and Contract Documents.

D. Schedule submittals to expedite the Project, and deliver to Architect/Engineer at business address. Coordinate submission of related items.

E. For each submittal for review, allow 15 days excluding delivery time to and from the contractor.

F. Identify variations from Contract Documents and Product or system limitations, which may be detrimental to successful performance of the completed Work.

G. Submittals not requested will not be recognized or processed.

1.5 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule in duplicate within 15 days after date established in Notice to Proceed.
B. Revise and resubmit as required.
C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
D. Submit a horizontal bar chart with separate line for each major portion of Work or operation, identifying first workday of each week.

1.6 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name and model number of each product.
B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation and reference standards.

1.7 PRODUCT DATA

A. Product Data For Review:
   1. Submitted to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
   2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

B. Product Data For Information:
   1. Submitted for the Architect/Engineer's knowledge as contract administrator or for the Owner.

C. Product Data For Project Closeout:
   1. Submitted for the Owner's benefit during and after project completion.

D. Submit the number of copies, which the Contractor requires, plus two copies that will be retained by the Architect/Engineer.

E. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information specific to this Project.

F. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - CONTRACT CLOSEOUT.

1.8 SHOP DRAWINGS

A. Shop Drawings For Review:
   1. Submitted to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
   2. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

B. Shop Drawings For Information:
   1. Submitted for the Architect/Engineer's knowledge as contract administrator or for the Owner.

C. Shop Drawings For Project Closeout:
   1. Submitted for the Owner's benefit during and after project completion.

D. Indicate special utility and electrical characteristics, utility connection requirements and location of utility outlets for service for functional equipment and appliances.

E. Submit in the form of one reproducible transparency and one opaque reproduction.

1.9 SAMPLES

A. Samples For Review:
   1. Submitted to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
   2. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

B. Samples For Information:
   1. Submitted for the Architect/Engineer's knowledge as contract administrator or for the Owner.

C. Samples For Selection:
   1. Submitted to Architect/Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes for Architect/Engineer selection.
   3. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

1.10 DESIGN DATA

A. Submit for the Architect/Engineer's knowledge as contract administrator or for the Owner.
B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.11 TEST REPORTS

A. Submit for the Architect/Engineer's knowledge as contract administrator or for the Owner.
B. Submit test reports for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.12 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Architect/Engineer, in quantities specified for Product Data.
B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.
C. Certificates may be recent or previous test results on material or Product but must be acceptable to Architect/Engineer.

1.13 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, and start-up, adjusting and finishing, to Architect/Engineer for delivery to owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention and special environmental criteria required for application or installation.
C. Refer to Section 01400 - Quality Control, Manufacturers' Field Services article.

1.14 MANUFACTURER'S FIELD REPORTS

A. Submit reports for the Architect/Engineer's benefit as contract administrator or for the Owner.
B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.15 ERECTION DRAWINGS

A. Submit drawings for the Architect/Engineer's benefit as contract administrator or for the Owner.
B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
C. Data indicating inappropriate or unacceptable Work may be subject to action by the Architect/Engineer or Owner.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - control of installation.
B. Tolerances
C. References and standards.
D. Mock-up.
E. Inspecting and testing laboratory services.
F. Manufacturers' field services.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.
B. Section 01600 - Material and Equipment: Requirements for material and product quality.
C. Section 01650 - Starting of Systems.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.5 REFERENCES AND STANDARDS

A. For Products or workmanship specified by association, trade or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids or date specified in the individual specification sections, except where a specific date is established by code.

C. Neither the contractual relationships, duties or responsibilities of the parties in Contract nor those of the Architect/Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.6 TESTING SERVICES

A. Contractor to provide all testing services as called out in these specifications.

B. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.

C. Testing does not relieve Contractor to perform Work to contract requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same MoDOT personnel on instructions by the Architect/Engineer.

1.7 INSPECTION SERVICES

A. Owner will employ MoDOT Personnel to perform inspection.

B. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Architect/Engineer or the Owner.

C. Inspecting does not relieve Contractor to perform Work to contract requirements.

1.8 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and the balancing of equipment as applicable and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Refer to Section 01300 - SUBMITTALS, MANUFACTURERS' FIELD REPORTS article.

PART 2 EXECUTION

2.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

2.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, telephone service, facsimile service and sanitary facilities.
B. Temporary Controls: enclosures and fencing, protection of the Work and water control.
C. Construction Facilities: progress cleaning and temporary buildings.

1.2 TEMPORARY ELECTRICITY

A. Cost: By Contractor; pay for temporary power service furnished by MoDOT.

1.3 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office and Architect/Engineer's field office at time of project mobilization.

1.4 FACSIMILE SERVICE

A. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office and Architect/Engineer's field office at time of project mobilization.

1.5 TEMPORARY WATER SERVICE

A. Connect to existing water source as directed for construction operations at time of project mobilization.
B. Contractor will reimburse Owner for water used in construction as agreed upon at time of project mobilization.

1.6 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.7 FENCING

A. Construction: Use plastic mesh safety fencing or better.
B. Provide 48” high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.8 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate and maintain pumping equipment.
B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.9 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.11 SECURITY

A. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism or theft.
B. Coordinate with Owner's security program.

1.12 ACCESS ROADS

A. Provide and maintain access to fire hydrants, free of obstructions.
B. Provide means of removing mud from vehicle wheels before entering streets.
C. Designated existing on-site roads may be used for construction traffic.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris and rubbish from site periodically and dispose off-site.
E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 FIELD OFFICES AND SHEDS

A. Office: Weather tight, with lighting, electrical outlets, heating and ventilating equipment and equipped with drawing rack and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities and materials prior to Final Application for Payment inspection.
B. Clean and repair damage caused by installation or use of temporary work.
C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.
B. Transportation and handling.
C. Storage and protection.
D. Product options.
E. Substitutions.

1.2 RELATED SECTIONS

A. Instructions to Bidders: Product options and substitution procedures.
B. Section 01400 - Quality Control: Product quality monitoring.

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
B. Provide interchangeable components of the same manufacture for components being replaced.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.
B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct and products are undamaged.
C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement or damage.

1.5 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive Products in weather tight, climate controlled, enclosures in an environment favorable to Product.

D. For exterior storage of fabricated Products, place on sloped supports above ground.

E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

F. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement or damage.

I. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description is acceptable.
B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.7 SUBSTITUTIONS

A. Architect/Engineer will consider requests for Substitutions only within 15 days after date established in Notice to Proceed.

B. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that the Contractor:
1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit shop drawings, product data and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
3. The Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01650

STARTING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting systems.
B. Demonstration and instructions.
C. Testing, adjusting and balancing.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Manufacturers field reports.
B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, and control sequence and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01300 that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Final Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance and shutdown of each item of equipment at agreed time, at equipment location.

E. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instruction.

F. The amount of time required for instruction on each item of equipment and system that's specified in individual sections.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Adjusting.
D. Project record documents.
E. Operation and maintenance data.
F. Spare parts and maintenance Products.
G. Warranties.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls: Progress cleaning.
B. Section 01650 - Starting of Systems: System start-up, testing, adjusting and balancing.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
B. Provide submittals to Owner that is required by governing or other authorities.
C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments and sum remaining due.
D. Owner will occupy portions of the building as specified in Section 01010.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

B. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

C. Clean or replace filters of operating equipment used during construction and/or adjustment.

D. Clean debris from roofs, gutters, downspouts and drainage systems.

E. Clean site; sweep paved areas, rake clean landscaped surfaces.

F. Remove waste and surplus materials, rubbish and construction facilities from the site.

1.5 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Store record documents separate from documents used for construction.

B. Record information concurrent with construction progress.

C. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

D. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish main floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

E. Submit documents to Architect/Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Submit 1 draft copy of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned with Architect/Engineer comments. Revise content of all document sets as required prior to final submission.

E. Submit two sets of revised final volumes, within 10 days after final inspection.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra Products in quantities specified individual specification sections.
B. Deliver to Project site; obtain receipt prior to final payment.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust and lubricate as required.
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
E. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

1.9 WARRANTIES

A. Execute and assemble transferable warranty documents from Subcontractors, suppliers and manufacturers.
B. Submit prior to final Application for Payment.
C. For items of Work delayed beyond date of Final Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of the warranty period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

PROJECT MANUAL
FOR

MISSOURI DEPARTMENT OF TRANSPORTATION WAREHOUSE RENOVATION PHASE II

830 MoDot Drive
Jefferson City MO 65109

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WAREHOUSE RENOVATION PHASE II

830 MoDot Drive

Jefferson City, MO. 65109

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STATE OF MISSOURI
MATTHEW JAMES RIMILLER
NUMBER A-2007019928
ARCHITECT
1-11-10

I hereby certify that this architectural document was prepared by me or under my direct personal supervision and that I am a duly licensed Registered Architect under the laws of the State of Missouri.

Signature: Matthew J. Rimiller Date: 01-11-2010

Name: Matthew James Rimiller

Missouri License Number: A-2007019928

My license renewal date is December 31, 2011.

Pages, Sheets, or Divisions covered by this seal: Division 1 (sections 01731 & 01732); Divisions 3,4,5,6,7, 8, 9,10,11 and 14.

STATE OF MISSOURI
MICHAEL MELVIN HALL
NUMBER E-30044
REGISTERED PROFESSIONAL ENGINEER
1-11-10

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Missouri.

Signature: Date: 01-11-2010

Name: Michael Melvin Hall

Missouri License Number: E-30044

My license renewal date is December 31, 2011.

Pages, Sheets, or Divisions covered by this seal: Division 2

STATE OF MISSOURI
FREDDIE L. MALICOAT
NUMBER E-16897
REGISTERED PROFESSIONAL ENGINEER
1-11-10

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Missouri.

Signature: Freddie L Malicoat Date: 01-11-2010

Name: Freddie L. Malicoat

Missouri License Number: E-16897

My license renewal date is December 31, 2011.

Pages, Sheets, or Divisions covered by this seal: Divisions 15 and 16

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. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
2. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

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

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

1.4 SUBMITTALS

A. Cutting and Patching Proposal: 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 In-Place 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. Construction Manager'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 in a manner that could change their load-carrying capacity or load-deflection ratio.

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

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.
8. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous 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. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

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.

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

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place 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 in-place 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 in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

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

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

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.

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots 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 into concealed surfaces.
3. Concrete: 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.

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 one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface

containing the patch. Provide additional coats until patch blends with adjacent surfaces.

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

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 1 Section "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

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

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

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

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

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. Qualification Data: For professional engineer.

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

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

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

1. Comply with submittal requirements in Division 1 Section "Construction Waste Management."

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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

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

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

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

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

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

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs, or preconstruction videotapes.

1. Comply with requirements specified in Division 1 Section "Photographic Documentation."
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

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

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

1. Building manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

    a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

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

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

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

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

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 1 Section "Construction Waste Management."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

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

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 1 Section "Construction Waste Management."

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. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 02060 – SITE DEMOLITION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Removal of Asphalt Pavement

B. Removal Concrete & Bollards

C. Removal & Relocation of Utilities

D. Install Protective Fencing and Signage.

E. Remove Materials and Debris from the Site.

F. Removal of Chain Link Fence & Posts

1.2 PROTECTION

A. Protect benchmarks, existing structures not being removed, fences, roads, sidewalks, paving and curb.

B. Protect above and below ground utilities which are to remain.

C. Install signage and fencing to protect the public from the demolition activities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Excavated open pits and holes caused as a result of demolition shall be backfilled with approved fill materials, free of organic matter and debris. Fill shall be applied and compacted according Earthwork Section 02220

PART 3 EXECUTION

3.1 PREPARATION

A. Protective Fencing and Signage
   1. The Contractor shall provide, erect and maintain temporary barriers and security devices. Protective fencing shall be installed to protect all adjoining public and private structures which will not be demolished. All fencing shall be maintained to a serviceable condition throughout the demolition procedures.

2. Demolition warnings signs shall be placed at appropriate locations throughout the site alerting traffic and pedestrians of the danger from demolition activities.
3. Flashing light barricades shall be provided between sunset and sunrise to properly protect persons and property from hazards of pits, excavations, fences, barriers, equipment, building materials or rubbish in, upon, or near sidewalks or streets.

3.2 EXECUTION

A. No blasting shall be permitted as a method of demolition.

B. Adjacent Structure and Thoroughfare Interference.
1. The Contractor shall take all means necessary (bracing, shoring, etc.) to prevent movement or settlement of adjacent structures and conduct demolition to minimize interference with these structures.
2. The Contractor shall also conduct operations with minimum interference to public or private thoroughfares and maintain protected egress and access at all times.

C. The demolition area, surrounding properties and traffic areas used in the demolition activities shall be effectively dust palliated. Such palliation shall include continuous watering and sprinkling during demolition operations, except when such water application creates hazardous or objectionable conditions.

D. All clearing, grubbing and tree removal shall conform to APWA specifications and criteria. All material from clearing, grubbing and tree removal operations together with buried logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 24 inches below finished grade.

E. Demolition.
1. Demolition shall include any incidental appurtenances attending these buildings or structures. Existing rubbish, trash and junk inside and outside the building and all of the material and debris from the demolished structures including any attending building appurtenances, shall be removed from the site as work on each item progresses, unless stated otherwise.

F. Material Removal.
1. The Contractor shall comply will all applicable laws and ordinances governing the disposal of materials, debris, rubbish and trash off the project site, and shall not trespass on any private property in the conduct of any work to be performed hereunder.
2. The Contractor shall be required to dispose of existing rubbish, trash and junk, as well as material, debris and wreckage resulting from demolition in a landfill which is licensed with the State of Missouri.
3. Demolished material shall be removed from the site as work progresses. Contractor shall leave the site in clean condition.

G. Open pits and holes caused as a result of demolition shall be backfilled with approved fill material. Areas located in a cut section of the site shall be graded to promote positive drainage. Areas located

in a fill section of the site shall be graded and compacted according to the recommendations of Terracon Consulting Engineers given in the geotechnical report.

H. The Contractor shall avoid damaging sidewalks, streets, curbs, pavements, utilities, structures or any other property (except that which is to be removed or replaced), either on or adjacent to the site. Items inadvertently damaged shall be repaired to their original condition at the Contractor's expense.

END OF SECTION

SECTION 02110-SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove surface debris.

B. Clear site of plant life and grass.

C. Remove trees and shrubs.

D. Remove root system of trees and shrubs.

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable codes and ordinances for disposal of debris.

B. Contractor shall notify the utility companies prior to commencement of construction and coordinate work with utilities as required.

PART 2 EXECUTION

2.1 PREPARATION

A. Verify that existing plant life designated to remain, is tagged or identified.

B. The contractor shall verify the location and depth of all utilities a minimum of 24 hours prior to construction. The Contractor may utilize the toll free number for the "Missouri One Call System, Inc." 1-(800) DIG-RITE. This number is applicable anywhere within the state of Missouri. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

2.2 PROTECTION

A. Locate, identify, and protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or negligent actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

C. Protect trees, plant growth, and features designated to remain, as final landscaping.

D. Protect from damage or displacement all project benchmarks and existing structures within or adjacent to the construction limits that are not to be removed or demolished.

2.3 CLEARING

A. Clear areas within construction limits unless otherwise shown on the plans.

B. Clear the site by removing all vegetation, on or above the surface of the site including but not limited to trees, shrubs, brush, grass, sod, down timber, roots, trash, objectionable material, and buried vegetation. All such vegetation shall be removed without removing more earth than is necessary

C. Remove structures and improvements within the construction limits such as fences, and signs. Any items indicated for salvage or reuse such as fence, guardrail and signs shall be removed with care and stored.

D. Grubbing shall be performed by removing and disposing of all vegetative matter such as stumps, roots, buried trees and brush below the ground surface or subgrade whichever is lower. Grubbed vegetation shall be removed a minimum depth of twelve (12) inches below ground line or subgrade whichever is lower. Deleterious materials encountered below the ground line which are detrimental to the proposed improvements shall be removed to a depth necessary to provide adequate support for the proposed improvements.

E. When undisturbed stumps and roots are encountered in embankment areas where the fill depth exceeds three (3) feet, the stumps and roots may be left in place provided the stumps are cut to extend no more than three (3) inches above the original ground line.

F. Areas used to excavate borrow material for embankment or fill shall have all stumps, roots and other objectionable matter removed. The borrow area shall be left in a well drained and smooth condition.

G. All trenches, holes and pits resulting from clearing, grubbing and removal on the site shall be backfilled with suitable fill material and compacted according to Section 02220 – Earthwork

H. Remove pavement, as indicated in the plans. When portions of such items are to remain in place, remove to an existing joint or new joint sawed to a minimum depth of two (2) inches or 1/4 the slab thickness, whichever is greater. The joint shall be true to line and vertical face.

2.4 REMOVAL

A. All debris, rock, extracted plant life and other materials except those designated for salvage or use in embankment shall become the Contractor's property and disposed of off site.

END OF SECTION

SECTION 02220 - EARTHWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavating for paving, Sidewalk and landscaping.

B. Site filling and backfilling.

C. Embankment and fill under paving

D. Consolidation and compaction.

E. Fill for over-excavation.

1.2 FIELD MEASUREMENTS

A. Verify that survey benchmarks and intended elevations for the Work are as indicated in the plans.

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Suitable Fill for Engineered Controlled Fill: Suitable fill material excavated on site is entirely imperishable containing no muck, frozen material, organic material, top soil or rubbish and less than

10 percent rock or gravel having a maximum dimension greater than 3 inches. That portion of the fill material passing the No. 40 sieve having a liquid limit not exceeding 40 and a plastic index not exceeding 25, when tested in accordance with ASTM D-4318.

B. Rock Embankment: Rock embankment material is suitable fill material containing, by volume, greater than ten percent rock or gravel having a maximum dimension greater than 3 inches but not greater than 24 inches.

C. Granular Fill: Granular fill is material with a gradation of at least 50 percent retained on the No. 4 Sieve and no more than 40 percent passing the No. 10 Sieve and a plasticity index not exceeding 10.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that required lines, levels, contours and datum are as shown in the plans.

B. The Contractor shall verify the location and depth of all utilities a minimum of 24 hours prior to construction. The Contractor may utilize the toll free number for the "Missouri One Call System, Inc." 1-(800) DIG-RITE. This number is applicable anywhere within the state of Missouri. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

C. Coordinate removal or relocation of existing utilities with their Owner

D. The Contractor shall maintain the site and conduct earthwork operations to ensure that the property is well drained at all times.

E. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with suitable fill material and compact to density equal to or greater than requirements for subsequent fill material.

F. Grading, excavation and backfilling shall be made to the lines, grades and cross sections indicated in the plans.

3.2 PROTECTION

A. Locate, identify and protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or negligent actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

C. Protect existing trees that are designated on the plans to remain against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect the trees to be left standing.

D. Protect benchmarks, existing structures, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

E. The Contractor shall protect all property corners and control monuments from damage or displacement. Should it become necessary to disturb any corner or monument, the Contractor shall be responsible for referencing the markers prior to removal, resetting them and filing such relocation in accordance with state and local regulations. All such work involving property corners and control monuments shall be performed by a registered, licensed land surveyor. A copy of all certification documents shall be submitted to the Engineer prior to completion of the project.

F. The Contractor shall protect adjacent and downstream properties from damage or pollution caused by erosion. The Contractor shall implement, as a minimum, all erosion control methods indicated on the plans and in the Storm Water Pollution Prevention Plan (SWPPP). The Contractor is responsible for erosion control measures and methods and shall conduct earthwork operations to ensure the protection of all downstream and adjacent properties. The Contractor shall implement any additional erosion control measures to prevent damage.

3.3 EXCAVATION

A. Excavation for Pavement: Excavate pavement areas to six (6) inches below subgrade elevation.

B. When materials are encountered during excavation which the Engineer deems unsuitable for use, the material shall be removed to the depth and limits ordered by the Engineer and backfilled with suitable fill material, rock fragments or spalls.

C. All suitable material removed by excavation shall be used as far as practicable for backfill and embankment as required to complete the work. The Contractor shall sort all excavated material and stockpile suitable material as necessary. Stockpile excavated material to be used as fill and backfill in area designated on site and remove excess material or unsuitable material not being reused, from site.

D. Notify the Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work

E. Correct areas over-excavated with suitable fill material compacted to 95 percent maximum dry density.

3.4 EMBANKMENT / COMPACTED FILL

A. All unstable or unsuitable material shall be removed from the existing surface to receive fill material prior to commencing embankment work.

B. Before placing any fill the existing surface shall be scarified, moisture conditioned as required and the top 6 inches compacted to 90 percent of the maximum density for that material in accordance with ASTM D-698.

C. When embankments, regardless of height, are placed against hillsides or existing embankments having a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be benched or stepped in approximately 24 inch rises. Fill shall be brought up in 12 inch maximum lifts. The material bladed out and the bottom area cut to form benches and the embankment material being placed shall be compacted to the specified density. Formation and compaction of benches shall not be measured and paid for directly but will be considered incidental work.

D. Where embankments of two feet or less are placed over existing pavement, the existing pavement shall be removed and the cleared surface compacted to the specified density. Where embankments greater than two feet are placed over existing pavement, the pavement shall be broken into pieces with a maximum dimension of 24 inches and the pieces left in place.

E. Do not place fill or backfill material over porous, wet, frozen or spongy surfaces Embankment construction shall not be performed when fill material is frozen or contains frost or snow.

F. Earth Embankment: Place earth embankments in successive horizontal lifts uniformly distributed over the full width of the fill area. Each lift shall not exceed 12 inches in loose thickness and shall be compacted to the specified density prior to placing any additional lifts. As compaction of each layer progresses, continuous blading and dozing will be required to level the surface and insure uniform compaction.

3.5 COMPACTION

F. After completion of roadway excavation to the required section, all material between the lines one foot outside the curb and within the top six inches of the subgrade shall be compacted to at least 95 percent of the maximum density for that material in accordance with ASTM D-698 and with a moisture content within minus 3 and plus 2 percent of the optimum moisture content.

G. All fill material within roadway or pavement areas shall be compacted to at least 95 percent of the maximum density for that material in accordance with ASTM D-698 and with a moisture content within minus 3 and plus 2 percent of the optimum moisture content.

H. All fill not within the line one foot behind the curb shall be compacted to 90 percent of the maximum density for that material as determined by ASTM D-698 and with a moisture content between minus 3 and plus 2 percent of the optimum moisture content.

I. In place compaction testing will be determined by the Standard Method of Test for Density of Soil in

Place by ASTM D-1556, D-2167, or D-2922. Moisture content testing will be performed in accordance with ASTM D-3017.

J. All work involved in obtaining the specified moisture content shall be considered incidental to the grading operations.

3.6 FINISHING

A. In areas to be seeded the upper 12 inches shall be earth material and the top six inches suitable for sustaining grass.

B. The graded surface shall be left free of rock, concrete, brick, fragments, or rubbish and shall be finished to the lines, grades and cross-sections indicated on the plans.

C. Protect finished work from damage or displacement. The Contractor shall reshape and recompact any damaged areas and shall leave the surface unmarred.

3.7 CLEAN UP

A. The Contractor shall clean the site as the work progresses. Final clean up shall follow immediately behind the finishing. The Contractor shall remove from the site all equipment, tools, unused materials and other construction items. The entire site shall be left in a neat, finished condition. Clean up shall be considered incidental to grading operations.

B. Remove all excavated material and excess fill materials from the site.

3.8 TOLERANCES

A. Top Surface of Backfilling under Paved Areas: Plus or minus 1/2 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be provided under provisions of FRONT END documents

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

C. Frequency of Tests: One test per 1000 sq ft per lift or as determined by engineer

END OF SECTION

SECTION 02270 - EROSION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Silt fence and hay bale silt fence erosion protection.

1.2 REFERENCES

A. Missouri Clean Water Commission

1.2 REGULATIONS

A. Perform Work in accordance with State of Missouri Clean Water Commission and City of Jefferson City Missouri.

B. Comply with all requirements, exemptions, regulations and outflow sampling requirements set forth in the Department of Natural Resources, Missouri State Operating Permit.

1.3 SUBMITTALS

A. Supply product data and manufacturer's certificate verifying that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Straw bale fence materials and construction shall be according to the details on the Erosion Control Plan.

B. Seeding materials are as noted on the Erosion Control Plan.

C. Anti-erosion mulch shall be clean, dry straw of winter wheat, rye, oats or barley.

2.2 SILT FENCE MATERIALS

A. Silt fence materials and construction shall be according to the details on the Erosion Control Plan. Silt fence material shall be a synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yard meeting the following requirements:
   1. Sediment retention efficiency shall be a minimum of 85 percent.
   2. Grab strength at 20 percent maximum elongation shall be 30 lb/Lin. in. for standard strength fabric and 50 lb./Lin. in. for extra strength fabric.
   3. Flow rate shall be a minimum of 0.3 gal./sq. ft./min.

4. Silt fence fabric shall contain ultraviolet ray inhibitors and stabilizers providing a minimum of six months usable construction life at a temperature range from 0 to 120□ F.

B. Silt fence posts shall be either 4 inch diameter pine, 2 inch diameter oak or 1.33 lb./ lin. ft. steel posts a minimum of 4 feet in length. Steel posts shall have projections for fastening the fabric.

C. Wire fence used to reinforce standard strength filter fabric shall have a maximum mesh size of 6" X 6" and a minimum of 14 gauge.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify location of erosion control devices.

B. Coordinate installation of erosion control devices with other work as required.

3.2 INSTALLATION

A. Location and installation of erosion control devices shall be according to the drawing details and specifications on the Erosion Control plan.

B. The Contractor shall protect adjacent and downstream properties from damage or pollution caused by erosion. The Contractor shall install, as a minimum, all erosion control methods indicated in the plans together with any additional temporary pollution control measures necessary to correct conditions that develop during construction.

3.2 SILT FENCE INSTALLATION

A. The siltation fence located along the perimeter of the site or grading limits shall be installed immediately following site clearing operations according to the details on the plan.

B. Install the filter fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints. Create joints in the filter fabric by securely fastening the fabric at the support post with overlap extending to the next post.

C. Standard strength filter fabric shall be supported with wire fence fastened to the upslope side of the posts with one inch long heavy duty wire staples or tire wires. When extra strength filter fabric is used with 8 foot post spacing, wire fence support is not required.

D. Support post shall be securely driven into the ground a minimum of 24 inches.

E. Excavate a 4 inch wide and 8 inch deep trench on the upslope side of the silt fence. Line the trench with filter fabric and backfill with soil or gravel.

3.3 STRAW BALE FENCE INSTALLATION

A. The straw bale fence shall be installed at the completion of grading operations in the affected area according to the details on the plan.

B. Erosion Control devices shall be installed at storm sewer inlets according to the detail on the plan as soon after completion of the storm sewer as possible.

C. Straw bales shall be placed in a single row, lengthwise on the contour and embedded 4 inches into the soil.

D. Each individual bale shall be securely anchored in place by stakes or reinforcement bars driven through the bales and a minimum of 18 inches into the ground.

3.4 MAINTENANCE

A. The Contractor shall check the sediment basin, silt fences and straw bale fences after each rainfall event to ensure that they are in proper working order. Check the embankment, spillway and outlet of the sediment basin for erosion, settlement or other damage. The Contractor shall make all necessary repairs immediately.

B. The Contractor shall inspect silt and straw bale fences at least once a week. Any portion of the siltation fences which collapse, tear, decompose or become ineffective shall be replaced immediately.

C. Remove any sediment deposits as necessary to provide adequate sediment storage and to maintain the integrity of the fence.

D. Erosion control devices shall remain in place and be maintained as specified until the site is stabilized by pavement, vegetation or other means. After the site is stabilized all erosion control devices, sediment and debris shall be removed from the site and the areas regraded, seeded and brought to final condition as shown in the plans.

END OF SECTION

SECTION 02275 - RIPRAP

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Riprap.

PART 2 PRODUCTS

2.1 STONE MATERIALS

A. All riprap shall be quarried rock, sound durable and angular in shape. No more than 10 percent shall have an elongation greater than 3 to 1 and no stone shall have an elongation greater than 4 to 1. All rock shall be free of cracks, seams or other defects. Shale or rock with shale seams will not be accepted.

B. Minimum weight of stone shall be 155 pounds per cubic foot. No more than 6 percent of the stones shall have a weight lighter than 10 pounds.

C. No more than 10 percent of the stone shall contain splitting, crumbling or spalling when subjected to 5 cycles of the sodium sulfate soundness test according to AASHTO T104.

D. 18 inch minimum thickness riprap shall have at least 60 percent of the pieces with a volume of one cubic foot or more and meet the following gradation:

Weight of Stone in lbs.	Percent Lighter By Weight
360	100 (minimum)
240	80 (maximum)
120	50 (maximum)
12	10 (maximum)

E. For Type II Rock Blanket at least 60 percent of the mass shall be stones having a volume of one cubic foot or more.

2.2 FILTER BLANKET MATERIALS

A. Granular filter material shall consist of sound durable rock conforming to the following gradation:

Sieve Size	Cumulative Percent Passing by Weight
1"	100
1/2"	70 - 100
No. 4	50 - 85
No. 10	35 - 70
No. 40	20 - 50
No. 100	15 - 40

B. Filter fabric used as a filtering blanket shall be a woven or nonwoven polypropylene, nylon or polyester filament fabric. The fabric shall have an open area not less than 4 percent and not greater than 10 percent providing an equivalent opening size no finer than a standard sieve No. 70. Filter fabric shall meet the following requirements:

1. The minimum grab tensile strength, warp wise and filling wise, shall be 200 pounds when tested according to ASTM D-1682.
2. Grab elongation shall not be less than 15 percent no more than 60 percent, warp wise and filling wise, when tested according to ASTM D-1682.
3. The minimum trapezoidal tear strength shall be 100 pounds, warp wise and filling wise when tested according to ASTM D-1117.
4. The minimum bursting strength shall be 400 psi when tested according to ASTM D-3887.
5. The minimum seam-braking strength of woven fabric shall be 180 pounds when tested in accordance with ASTM D-1683.
6. Filter fabric shall be furnished in widths of not less than 6 feet.

PART 3 EXECUTION

3.1 PREPARATION

A. Grade and trim the area to receive riprap or stone blanket to the dimensions and sections shown in the plans within a tolerance of plus or minus 2 inches from the planned lines and grades. All deleterious material shall be removed from the subgrade area.

B. Area to receive riprap or stone blanket shall be compacted to a uniform density as required for adjacent material.

3.2 RIPRAP PLACEMENT

A. Place 18 inch minimum thickness riprap as shown in the details on the plans.

B. Riprap shall be hand or machine placed on compacted subgrade in a well graded mass of stone with a minimum percentage of voids. Riprap layer shall be placed to full-course thickness in one operation in such a manner to avoid displacing the underlying material.

C. Place riprap so that the surface is uniform and conforms to the lines and contours shown in the plans.

D. When filter fabric is used, the Contractor shall place the riprap in such a manner to not tear, puncture or displace the fabric. Riprap shall not be dropped more than three feet when being placed on filter fabric. Tears or rips in the filter fabric shall be repaired with fabric lapped a minimum of 12 inches in all directions.

E. Dumping riprap into chutes, placing in layers or other methods of placement which cause segregation will not be permitted.

F. The larger stones shall be well distributed throughout the riprapped area. The entire riprap area shall conform to the specified gradation. All material shall be placed and distributed so that there are no objectionable accumulations of larger or smaller sized stones.

G. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to produce fairly compact riprap with all sizes of material placed in their proper proportion.

H. Backfill riprap area to the lines and contours shown on the plans and compact to [90 percent maximum density.

3.3 STONE BLANKET PLACEMENT

A. Place stone blanket as shown on the details in the plans.

B. Place 18 inch minimum thick riprap for stone blankets as specified for riprap placement in paragraph 3.2, Riprap Placement.

C. Place riprap so that flat sides are in contact, eliminating large voids.

D. Backfill stone blanket area to the lines and contours shown on the plans and compact to 90 percent maximum density.

3.4 PROTECTION

A. Protect storm sewer pipe and culverts from damage or displacement during riprap placement.

END OF SECTION

SECTION 02277 - SEGMENTAL RETAINING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes furnishing and installing segmental retaining wall (SRW) units to the lines and grades designated on the construction drawings or as directed by the Engineer. Also included is furnishing and installing appurtenant materials required for construction of the retaining wall as shown on the construction drawings..

1.2 REFERENCES

A. ASTM C 90 - Load Bearing Concrete Masonry Units

B. ASTM C 140 - Sampling and Testing Concrete Masonry Units

C. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method

D. NCMA TEK 50A - Specifications for Segmental Retaining Wall Units

E. NCMA SRWU-1 - Determination of Connection Strength between Segmental Concrete Units

F. NCMA SRWU-2- Determination of Shear Strength between Segmental Concrete Units

G. NCMA Design Manual for Segmental Retaining Walls

H. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.

1.3 CERTIFICATION

1. Contractor shall submit a notarized manufacturers certification prior to start of work stating that the SRW units meet the requirements of this specification.

1.4 QUALITY ASSURANCE

A. Contractor shall check the materials upon delivery to assure that specified type, grade, color and texture of SRW unit has been received.
B. Contractor shall prevent excessive mud, wet concrete, epoxies, and like materials which may affix themselves from coming in contact with the materials.
C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated into the reinforced soil wall.

PART 2 - PRODUCTS

2.1 SEGMENTAL RETAINING WALL UNITS

A. SRW units shall be machine formed concrete blocks specifically designed for retaining wall applications.

B. SRW units shall meet the following architectural requirements:
   1. Finish of units shall be split-faced.
   2. Unit faces shall be flat.
   3. Units shall be erected with a running configuration.
   4. All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the construction. Cracking of excessive chipping may be grounds for rejection.

C. SRW units shall meet the following structural requirements:
   1. Concrete used to manufacture SRW units shall have a minimum 28 day compressive strength of 3000 psi in accordance with ASTM C 90. The concrete shall have adequate freeze/thaw protection with a maximum moisture absorption rate, by weight, of: 6% in northern climates.
   2. Units shall be positively interlocked to provide a minimum shear capacity au =600 lb/ft and λu=34E as tested in accordance with NCMA SRWU-1.
   3. Units shall provide a minimum connection strength between it and the geosynthetic reinforcement of acs=600 lb/ft and λcs=56E as test in accordance with NCMA SRWU-2, if required.

   4. SRW units molded dimensions shall not differ more than ± 1/16 inch.

D. SRW units shall meet the following constructability and geometric requirements:

E. Units shall be positively engaged to the unit below so as to provide minimum of 3/32 inch horizontal setback per vertical foot of wall height.

F. Contractor shall submit color sample and two units to the Owner for approval prior to installation.

2.2 LEVELING PAD AND UNIT FILL MATERIAL

A. Material for footing shall consist of compacted sand or gravel and shall be a minimum of 6 inches in dept.

B. Fill for units shall be the free draining gravel or drainage fill.

C. Do not run mechanical vibrating plate compactors on top of the units. Compact unit fill by running hand-operated compaction equipment just behind unit. Compact to minimum 95% standard Proctor density (ASTM D 698) or 90% of modified Proctor density (ASTM D 1557).

2.3 DRAINAGE AGGREGATE (Unit Fill)

A. Drainage layer materials shall be 3/4" crushed stone or gravel.

B. Vertical drainage layer behind the wall face shall extend the entire length.

2.4 INFILL SOIL (Reinforced Backfill)

A. The infill soil material shall match the unit fill of 3/4" crushed stone or gravel.

B. The infill soil shall be compacted in maximum 8 inches compacted lifted to the following minimum densities (percentage of the maximum standard Proctor) (ASTM D 698): I) fine grained (ML-CL, SC, SM) soils to a minimum of 95%; and ii) coarse grained (GP, GW, SW, SP) soils to a minimum of 98%.

2.5 COMMON BACKFILL (Retained Soil)

A. Soil placed behind the infill can be any inorganic soil with a liquid limit less than 50 and plasticity index less than 30, or existing soil on site.

B. Backfill shall be compacted to a minimum 90% of maximum standard Proctor density (ASTM D 698).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over- excavation shall be filled with compacted infill material, or as directed by the Engineer, at the Contractors expense.

B. Engineer will inspect the excavation and approve prior to placement of bearing pad material.

C. Excavation of deleterious soils and replacement with compacted infill material, as directed by the Engineer, will be paid for at the contract unit prices.

D. Over-excavated areas in front of wall face shall be filled with compacted infill material at the Contractors expense, or as directed by the Architect/Engineer.

E. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation.

3.2 LEVELING PAD CONSTRUCTION

A. Leveling pad shall be placed as shown on the construction drawings with a minimum thickness of 6 inches.

B. Foundation soil shall be proofrolled and compacted to 95% of standard Proctor density and inspected by the Engineer prior to placement of leveling pad materials.

C. Leveling pad shall be prepared to insure intimate contact of retaining wall unit with pad.

3.3 SEGMENTAL UNIT INSTALLATION

A. First course of SRW units shall be placed on the leveling pad. The units shall be checked for level and alignment. The first course is the very important to insure accurate and acceptable results.

B. Insure that units are in full contact with base.

C. Units are placed side by side for full length of straight wall alignment. Alignment may be done by means of a string line or offset for base line to a molded finished face of the SRW unit. Adjust unit spacing for curved sections according to manufacturer=s recommendation.

D. Install shear connectors (if applicable).

E. Place unit fill (if applicable)

F. Place and compact fill behind and within units.

G. Clean all excess debris from top of units and install next course. Ensure each course is completely filled prior to proceeding to next course.

H. Lay each successive course ensuring that shear connectors are engaged.

I. Repeat procedures to the extent of the wall height.

J. Uppermost row of SRW units or caps shall be glued to underlying units with an adhesive, as recommended by the manufacturer.

END OF SECTION

SECTION 02510 - ASPHALTIC CONCRETE PAVING – ALTERNET BID

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphaltic concrete paving surface course.

B. Asphaltic concrete paving base course.

C. Recycling asphaltic pavement.

D. Subgrade preparation.

E. Aggregate base course.

1.2 REFERENCES

A. Midwest Concrete Industry Board (MCIB) Standard Specifications, Section 4, aggregate materials.

B. ASTM C - 117: Test Method for Material Finer Than No. 200 Sieve in Mineral Aggregates by Washing.

C. ASTM C - 136: Test Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ASTM D - 698: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures.

E. ASTM D - 946: Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.

F. ASTM D - 979: Methods for Sampling Bituminous Paving Mixtures.

G. ASTM D - 1075: Test Method for Effect of Water on Cohesion of Compacted Bituminous Mixtures.

H. ASTM D - 1559: Resistance to Plastic Flow of Bituminous Mixtures Using the Marshall Apparatus.

C. ASTM D - 1856: Test Method for Recovery of Asphalt from Solution by Abson Method.

D. ASTM D - 2171: Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer.

E. ASTM D - 2172: Test Method for Quantitative Extraction of Bitumen from Bituminous paving Mixtures, Method 'A'.

F. ASTM D - 4552: Standard Practice for Classifying HOT MIX Recycling Agents.

G. MS - 2: Mix Design Methods for Asphalt Concrete and Other HOT MIX Types, Asphalt Institute.

1.3 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

1.4 SUBMITTALS

A. Submit under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Submit certified laboratory test reports sufficient to verify compliance of specified mix design for all asphalt products. A copy of the certified analysis shall accompany each shipment of asphalt to the project.

C. Submit temperature-viscosity relationship data for each asphalt used on the project.

D. Submit copies of all freight bills and weigh bills for all asphalt shipments.

PART 2 PRODUCTS

2.1 ASPHALT MATERIALS

A. Asphalt Cement: Asphaltic cement shall conform to ASTM D946.

B. Coarse Aggregate: Coarse aggregate shall be in accordance with MCIB Section 4 - Paragraph 2, except that the total shale, clay, coal and lignite content shall not exceed 0.5 percent by weight.

C. Fine Aggregate: Fine aggregate shall be in accordance with MCIB Section 4 - Paragraph 3.

2.2 ASPHALT ACCESSORIES

A. Primer: Homogeneous, medium curing, liquid asphalt, Type MC-70.

B. Tack Coat: Homogeneous, medium curing, liquid asphalt, Type RC-70.

C. Sand Cover: Sand cover used for blotting excess primer shall be clean granular mineral meeting the following gradation:

Sieve Size	Percent Passing
No. 4	100
No. 200	0-2

The moisture content of the sand shall not exceed 3 percent by weight.

2.3 ASPHALT PAVING MIX

A. Use dried and heated material to avoid foaming. Mix uniformly.

B. Asphaltic Concrete Base Course Type 1-01: Asphalt base shall contain 4 to 6 percent of asphalt cement by weight in mixture. Mineral aggregates shall conform to the following gradation:

Sieve Size	Percent Passing By Weight
1 1/2"	100
1"	75-100
3/4"	60-85
1/2"	----
3/8"	40-65
No. 4	30-50
No. 8	19-36
No. 16	13-26
No. 30	----
No. 50	----
No. 100	4-12
No. 200	2-10

1. In addition to the above limits, the difference between the "percent passing" of successive sieve sizes shall not exceed 25 percent.
2. At the Contractor's option Asphalt Base may contain up to 50 percent Reclaimed Asphalt Pavement (RAP) and/or Reclaimed Aggregate Materials (RAM).
3. Recycled Asphaltic Concrete Material shall have the following additional tests performed:
   a. ASTM C-117 Standard Test Method for Material Finer than No. 200 Sieve in Mineral Aggregates by Washing.
   b. ASTM C-136 Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. ASTM D-2172 Standard Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures, Method "A".
4. The extracted asphalt from Method "A" ASTM D-2172 shall be reclaimed from solution in accordance with ASTM D-1856 Standard Test Method for Recovery of Asphalt from Solution by Abson Method.
   a. The consistency of the asphalt shall be determined on the basis of viscosity at 140 degrees F in accordance with ASTM D-2171 Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer.
   b. The grade of asphalt used in recycled mixes shall be the same grade as for virgin mixes.

5. New asphalt cement added to recycled asphalt shall meet the requirements of ASTM D-3381,

Standard Specification for Viscosity-Graded Asphalt Cement for use in Pavement Construction or ASTM D-946, Standard Specification for Penetration-Graded Asphalt Cement for use in Pavement Construction.

6. Any material obtained from cut-back asphaltic concrete streets or road-oil-chip seal streets is unacceptable for recycled asphaltic concrete.
7. Recycling Agents, if used, shall meet the requirements of ASTM D-4552 Standard Practice for Classifying HOT MIX Recycling Agents.
8. The blend of RAP and/or RAM and virgin aggregates shall be checked for resistance to stripping. Use ASTM D-1075 Standard Test Method for effect of Water on Cohesion of Compacted Bituminous Mixtures. The index of retained strength shall exceed 75 percent.
9. Maintain stockpiles of RAM and RAP at the plant separated on the basis of mix type-surface, binder and base. Stockpiles shall be free of foreign matter. RAM and/or RAP shall be processed such that 100 percent passes the 1 1/2 inch sieve and 90 percent passes the 1 inch sieve.
10. RAP and/or RAM stockpiles shall be free of all foreign matter, including but not limited to ice, wood, soil, broken sewer castings, loop detector wire, joint filler material, lane markers, trash and debris.
11. Mix Design Requirements: Mix design for recycled mixtures shall be in accordance with the Asphalt Institute's Manual Series No. 20 (MS-20) titled Asphalt Hot-Mix Recycling Section 3.00.
12. All delivery tickets of asphaltic pavement material shall designate the type of recycled mix (RC - Type 1, RC - Type 2, RC - Type 3, or RC - Type 4).

C. Asphaltic Concrete Surface Course Type 4-01: Surface course Type 4-01 shall consist of all virgin material with 5 to 7.5 percent of asphalt cement by weight in mixture. Mineral aggregates shall conform to the following gradation:

Sieve Size	Percent Passing By Weight
1/2"	100
3/8"	85-100
No. 4	55-75
No. 8	39-50
No. 16	27-38
No. 30	19-30
No. 50	11-23
No. 100	6-16
No. 200	4-10

1. In addition to the above limits, the difference between the "percent passing" of successive sieve sizes shall not exceed 20 percent.

D. All asphaltic concrete paving mixes shall be prepared and tested in accordance with ASTM D-1559 and shall meet the following design criteria.

1. The maximum loading for the Marshall Stability test shall be a minimum of 1500 pounds for asphaltic concrete Type 4-01.
2. Test specimens for the Marshall Stability test shall be compacted with 50 blows by the compaction hammer.
3. The flow value of the asphalt test specimen for all asphalt mixes at maximum loading shall be between 0.08 inches and 16.0 inches.
4. The percentage of air voids in laboratory specimens shall be from 1 to 8 percent for asphalt base course and from 1 to 5 percent for asphalt surface course.
5. The percentage of voids in mineral aggregates shall be according to the following:

Aggregate Size (maximum)	Percent Voids (minimum)
1 1/2"	12
1"	13
3/4"	14
1/2"	15
3/8"	16

E. Asphalt mixing plant and machinery requirements shall meet those regulations set forth in the American Public Works Association (APWA) Standard Specifications, Section 2200, Paving.

2.4 AGGREGATE BASE COURSE

A. Coarse aggregate base shall be crushed stone free of lumps or balls of clay and any other soft or objectionable material. Gradation shall be in accordance with ASTM C-136 and the following:

Sieve Size	Percent Passing By Weight
1 1/4"	100
1"	72-100
3/4"	60-90
3/8"	43-74
No. 4	28-60
No. 10	16-40
No. 40	3-22
No. 200	0-15

The difference between the percent passing of successive sieve sizes shall not exceed 25 percent.

B. The coarse aggregate base material shall be angular particles with a minimum of 90 percent of the stones having two or more fractured surfaces.

C. The specific gravity for base coarse aggregate shall not be less than 2.54 (S.S.D. Bulk).

D. The abrasion loss for the aggregate when subjected to 500 revolutions in a Los Angeles abrasion machine, according to ASTM C-131, shall be no more than 35 percent.

E. That portion of the aggregate passing the 1 inch sieve and retained on the No. 4 sieve shall have, by weighted average, a loss not greater than 10 percent when subjected to five cycles of the Soundness Test, ASTM C-88. Also this same potion of the material shall contain less than 20 percent by weight particles which have a thickness to least width ratio of 1 to 3 and least width to length ratio of 1 to 3.

F. That portion of the material passing the No. 40 sieve shall have a maximum plasticity index of 8 when tested in accordance with ASTM D-4318.

2.5 SOURCE QUALITY CONTROL

A. Provide tests of mix design for asphalt under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Submit proposed mix design of each class of mix for review prior to commencement of work.

C. Asphaltic concrete test samples shall be taken according to ASTM D-979 and tested for Bitumen content according to ASTM D-2172.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify base conditions are according to the plans and specifications.

B. Verify that subgrade under the new pavement section is compacted to 95 percent standard maximum density and is dry and free from all loose and foreign material.

C. Verify that the area to be paved is true to line and grade.

D. Where base is rough and uneven, a leveling course shall be placed and compacted to 95 percent standard maximum density prior to placement of asphalt pavement courses.

E. When a leveling course is not required, all depressions and irregularities shall be patched, corrected and compacted prior to commencing paving operations.

3.2 SUBBASE

A. Subgrade shall be compacted to 95 percent of the standard maximum density. If proper compaction cannot be achieved, remove soft material, replace with suitable fill material and compact to 95 percent standard maximum density.

3.3 COMPACTED AGGREGATE BASE COURSE

A. Verify that the subgrade has been cleared of all foreign matter and has been compacted to the specified density.

B. Place aggregate base course to the width and thickness indicated in the plans. The material shall be uniformly spread in successive layers to achieve the specified depth, but in no case shall any individual layer have a compacted thickness greater than 4 inches. Each layer shall be compacted to at least 95 percent maximum density, according to ASTM D-698, prior to placing any additional material.

C. After spreading, the aggregate shall be kept at the proper moisture content to insure the specified compaction. Water shall be added and uniformly mixed in such a manner to prevent segregation. Excess moisture creating runoff shall be avoided. If the aggregate and subgrade become too wet for proper work and compaction, the materials shall be allowed to dry sufficiently.

D. Work causing segregation of the aggregate is not permitted. If segregation of the aggregate in excess of 10 percent variation from the specified gradation or if the materials become contaminated, the segregated and contaminated material shall be removed and replaced with suitable material at the Contractor's expense. The in-place gradation shall be tested by a sieve analysis of a minimum of 100 pounds if in-place base course. If crushed stone is used, the segregated surface areas may be corrected by adding limestone screens of the gradation and quantity required to fill the surface voids and create a firmly bound material.

E. Shape and compact the aggregate base continuously until the proper grade, cross-section and specified density have been obtained. Final rolling shall be performed with a self-propelled smooth wheeled roller.

3.4 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient temperature is less than 40 degrees F, or when there is frost in the subgrade or any other time when weather conditions are unsuitable for the type of material being placed.

B. The minimum temperature of asphaltic concrete when placing shall be 285 degrees F when the ambient temperature is 40 degrees - 50 degrees F, 280 degrees F when the ambient temperature is from 50 degrees - 60 degrees F and 275 degrees when the ambient temperature is above 60 degrees F.

C. Do not place asphalt when water is standing on the surface to be paved.

3.5 PREPARATION - PRIMER

A. Apply primer on base or sub-base over subgrade surface at a uniform rate of 0.10 to 0.20 gal/sq yd with an application temperature of 150 degrees to 225 degrees F.

B. Apply primer to contact surfaces of rock and any existing asphalt surface at a uniform rate of 0.20 to

0.50 gal/sq. yd. for asphalt surfaces.

C. Use clean sand to blot excess primer.

3.6 PREPARATION - TACK COAT

A. Apply tack coat on asphalt or concrete surfaces at uniform rate of 0.05 to 0.12 gal/sq yd (0.226 to 0.543 L/sq m) with an application temperature of 150 degrees to 225 degrees F.

B. Apply tack coat to contact surfaces of curbs, gutters, vertical faces of existing pavement and all existing structures that come in contact with the asphalt. The applications temperature when applied to both surfaces shall be between 150 degrees and 225 degrees F.

C. The asphalt emulsion may be diluted from 1:1 to 1:3 parts emulsion to water.

D. Coat surfaces of manhole, catch basin and frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.7 ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt surface course within 24 hours of applying primer or tack coat.

B. Placement and finishing of each course shall be according to the thickness and width indicated on the plans. The thickness of individual lifts shall not exceed 4 inches for base course and 2 inches for surface course, Type 4-01

C. Install any storm drainage inlet grates and frames, manhole frames and other structures in correct position and elevation prior to laying asphalt.

D. The base and surface courses shall be spread and struck-off with mechanical paving machines meeting the requirements setforth in APWA Standard Specifications, Section 2205.

E. Longitudinal joints and edges shall be constructed to true line markings. The lines used for placement of individual lanes will be established parallel to the roadway. The pavers shall be positioned and operated to follow the established line. When using pavers in echelon, the second paving machine shall follow the asphalt edge placed by the first machine.

F. Immediately after spreading the first load of asphalt pavement, check the texture of the unrolled surface for uniformity. Segregation of materials shall not be permitted. If segregation occurs, suspend spreading operations immediately until the cause is determined and corrected.

G. Traverse joints in successive courses shall be offset a minimum of two feet and longitudinal joints shall be offset a minimum of six inches.

H. Edges which are to receive additional pavement shall be beveled at a 30□ angle with the vertical

plane. Form the true line and beveled edge immediately behind the paver with a lute or rake. Excess material shall be removed and indentations shall be filled with hot mix and smoothed. Fanning of material shall not be permitted.

I. Irregularities in the alignment shall be corrected by trimming directly behind the paving machine. Immediately after trimming, the edges shall be thoroughly compacted by tamping, avoiding any distortion to the pavement.

J. Hand place asphaltic concrete in those areas inaccessible to the paving machinery.
   1. Distribute asphalt material uniformly to avoid segregation. Broadcasting of material shall not be permitted.
   2. Using lutes and rakes thoroughly loosen and uniformly distribute the asphalt material. Lumps and material which does not readily break down shall be rejected.
   3. Following hand placing and prior to rolling, check the surface for irregularities with templates and straight edges. All irregularities shall be corrected.

K. When placing the surface course adjacent to any existing or previously finished surface, it shall be placed sufficiently high so that after compaction the finished surface shall be smooth and uniform with the adjacent surface.

3.8 ASPHALTIC CONCRETE PAVEMENT COMPACTION

A. The rolling equipment used for compaction of asphaltic pavement shall conform to the requirements setforth in the APWA Standard Specifications, Section 2205. A minimum of two rollers shall be required at all times.

B. Compact pavement by rolling. Do not displace or extrude pavement from position. Any displacement resulting from reversing the direction of the roller, or from any other cause, shall be corrected immediately using rakes and adding fresh asphalt when required.

C. To prevent adhesion of asphalt to the roller, the wheels shall be kept properly moistened. Excess water will not be permitted.

D. Traverse Joints: Traverse joints shall be carefully constructed as specified and thoroughly compacted to provide a smooth riding surface.
   1. Repair or correct the joint surface if it has become distorted. The joint shall be trimmed to a line. Apply a thin coating of asphalt tack coat to the joint face prior to placing fresh asphalt against it.
   2. Traverse joints shall be held to a minimum. At the end of the day's paving operation all lanes shall be completed to approximately the same station.

E. Longitudinal Joints: Longitudinal joints shall be rolled directly behind the paving operation.
   1. The first lane shall be placed true to line and grade. The asphalt material shall overlap the edge of the previously placed lane by 2 to 4 inches. The width and depth of the overlap shall remain uniform along the length of the joint.

2. Before rolling, the coarse aggregate in the material overlapping the joint shall be carefully removed with a rake or lute and discarded.

F. Edges: Pavement edges shall be rolled concurrently with or immediately following rolling the longitudinal joint.
   1. Before compaction, the material along the unsupported edge shall be slightly elevated with a tamping tool or lute. During rolling the wheels shall extend approximately one inch beyond the edge of the pavement.

G. Initial Rolling: Initial or breakdown rolling shall immediately follow rolling of the longitudinal joints and edges and as close behind the paving machine as practical to obtain the specified density without causing displacement.
   1. Initial rolling shall be performed with a smooth-wheeled roller having the drive wheel nearest the finishing machine.
   2. Rolling shall be longitudinal, commencing at the nearest edge of the pavement and proceeding toward the center while working from the low side to the high side. Overlap of the roller on successive trips shall not be less than one-third and no more than one-half the width of the roller. Vary the length of alternate rolling trips.
   3. Initial rolling shall take place as closely behind the paving machine as the temperature and mat condition will allow.

H. Intermediate Rolling: Intermediate rolling shall follow initial rolling as closely as possible and while the asphalt is still at a temperature which will result in the maximum density.
   1. The pneumatic-tire roller used for intermediate rolling shall conform to the requirements setforth in the APWA Standard Specifications, Section 2205.

   2. Intermediate rolling shall be continuous until all of the asphalt pavement has been compacted to the required density. Turning pneumatic-tired rollers on hot asphalt which causes displacement shall not be permitted.

I. Finish Rolling: Finish rolling shall be performed while the pavement is warm enough to remove all roller marks.
   1. A trench roller shall be used for finish rolling. Finish rolling shall continue until the course is thoroughly compacted with a smooth surface true to crown and grade.

J. At the completion of the compaction and rolling operations the asphaltic concrete base, Type 1-01 shall have a minimum density of 95 percent. The asphaltic concrete surface course shall have a density of 97 percent. All unsatisfactory work shall be corrected, repaired or replaced. The surface course shall have a uniform texture and conform to the lines and grades shown on the plans.

3.9 ASPHALT PAVEMENT TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from True Elevation: Within 1/4 inch.

3
3.10 FIELD QUALITY CONTROL

A. Field testing will be performed under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Take samples and perform tests in accordance with Asphalt Institute's MS-2 and ASTM D-979, ASTM D-2172 and ASTM D-1856.

3.12 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury until asphalt is sufficiently cooled so as not to be damaged by traffic loads.

END OF SECTION

SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING – BASE BID

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete pavement, curb and gutter, sidewalk and driveway.

B. Aggregate base course.

1.2 REFERENCES

A. Midwest Concrete Industry Board (MCIB) Standard Specifications for Concrete Work, Sections 3-1, 4-1, and 4-4, revised November 1999.

B. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

D. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

E. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

F ASTM C33 - Concrete Aggregates.

G ASTM C131 - Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

H. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

I. ASTM C150 - Portland Cement

J. ASTM C260 - Air-Entraining Admixtures for Concrete.

K. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

L. ASTM C494 - Chemical Admixtures for Concrete.

M. ASTM D698 - Moisture Density Relations of Soils and Soil Aggregate Mixtures.

N. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

O. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

P. FS TT-00227 and TT-00230-C - Rubberized Polysulfide Urethane Joint Sealing Compound for

Concrete Pavement.

1.3 SUBMITTALS

A. Submit under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Product Data: Provide data on mix design, joint filler, admixtures, and curing compounds.

1.4 QUALITY ASSURANCE

A. The Contractor is responsible for placing concrete when conditions are conducive to proper curing.

B. Perform work in accordance with MCIB Standard Specifications.

C. Obtain materials from same source throughout.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when subgrade, forms or equipment are wet or frozen or contain ice or snow. Cold weather concrete work, when the air temperature is below 35 degrees F, shall conform to MCIB Standard Concrete Specification, Section 4-4.

B. Hot weather concrete work, when the air temperature is above 80 degrees F, shall conform to MCIB Standard Concrete Specification, Section 4-4.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms shall be in good condition, clean and free of imperfections. Each form shall not vary more than 1/4 inch in horizontal and vertical alignment for each 10 feet in length.

B. Forms shall be metal with a height equal to or greater than the specified thickness of the pavement slab or curb height.

C. Forms shall be of sufficient cross section and strength and secured to withstand all pressures and loads imposed on it by concrete placement, vibration and finishing including any loads or impact from equipment.

D. Slip form paving and curb machines may be used in place of forms. The machine shall be equipped with mechanical internal vibrators and capable of placing pavement or curb to the correct thickness, cross section, line and grade within the allowable tolerances.

2.2 JOINT MATERIALS

A. Expansion joint filler for concrete pavement shall conform to ASTM D-1752.

B. Expansion joint material for concrete curb and gutter, sidewalk and driveway shall be a pre-formed, one piece, non-extruding material such as "Bondex" No. 941 pre-formed rubber joint, "Rubatex", both manufactured by Rubatex Company or approved equal.

C. Joint sealing compound for concrete pavement shall be a one or two component rubberized polysulfide urethane conforming to Federal Specification Number TT-00227 or TT-00230-C.

D. Joint sealing compound for concrete curb and gutter shall be a one component, gun-grade, moisture cured epoxy or urethane such as "Valcum 45" manufactured by Maneco International, "Sikaflex 1-A" by Sika Chemical Corporation or "Pecora CG-9" by Pecora Company or approved equal.

2.3 REINFORCEMENT

A. Steel bar reinforcement for concrete pavement and curb dowels shall conform to ASTM A-615, A-616 or A-617.

B. Welded wire fabric shall be 6”X 6” W4.0 X W4.0 conforming to ASTM A-185.

2.4 CONCRETE MATERIALS

A. Portland cement shall conform to ASTM C-150, Type I.

B. Coarse aggregate shall conform to MCIB, Section 4-1. Only limestone from the Bethany Falls or Calloway ledges shall be used.

C. Fine aggregate shall conform to MCIB Section 4-1.

D. Water shall be potable, not detrimental to concrete.

E. Air entrainment admixture shall be a neutralized vinsel resin type such as adair or an approved equal conforming to ASTM C-260.

2.5 AGGREGATE BASE MATERIAL

A. Aggregate base material shall be crushed stone free of lumps or balls of clay and any other soft or objectionable material. The coarse aggregate shall be angular particles with a minimum of 90 percent of the stones having two or more fractured surfaces. The gradation shall be in accordance with ASTM C-136 and the following:

Sieve Size	Percent Passing By Weight
1-1/4"	100
1"	72-100
3/4"	60-90
3/8"	43-74
No. 4	28-60
No. 10	16-40
No. 40	3-22
No. 200	0-15

The difference between the percent passing of successive sieve sizes shall not exceed 25 percent.

B. The specific gravity shall not be less than 2.54 (S.S.D. Bulk).

C. The portion of the aggregate passing the 1 inch sieve and retained on the No. 4 sieve shall contain less than 20 percent, by weight, particles which have ratios of thickness to least width and of least width to length greater than 1 to 3. Also this same portion of the material shall have, by weighted average, a loss not greater than 10 percent when subjected to 5 cycles of the Soundness Test, ASTM C-88.

D. The abrasion loss for the aggregate when subjected to 500 revolutions in a Los Angeles abrasion machine, according to ASTM C-131, shall be no more than 35 percent.

E. That portion of the material passing the No. 40 sieve shall have a maximum plasticity index of 8 when tested in accordance with ASTM D-4318.

2.6 ACCESSORIES

A. Liquid membrane curing compound for use on pavement, curb and gutter, sidewalk and driveways shall conform to one of the following types.
   1. A white-pigmented, two component water insensitive epoxy having a solid epoxy content of 40 to 60 percent. The application rate is 5 to 8 mils wet.
   2. A liquid, white-pigmented, system of styrene acrylate Type I - Class 2 or liquid chlorinated rubber Type II - Class 2, complying with Federal Specification No. TT-C-800A. The application rate shall be 6 to 10 mils wet.
   3. A fan pattern spray nozzle shall be used when applying liquid curing membrane.

2.7 CONCRETE MIX

A. Portland cement concrete used in construction of concrete pavement shall conform to MCIB Mix No. A558-1-2-0.421.

B. Portland cement concrete used in construction of concrete curb and gutter shall conform to MCIB Mix No. A558-1-2-0.421 or WA610-1-4-0.410.

C. Portland cement concrete used in construction of concrete sidewalk and driveways shall conform to MCIB Mix No. WA610-1-4-0.410.

2.8 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of concrete used to Engineer for review prior to commencement of work.

B. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301 and MCIB Standard Concrete Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that aggregate base is compacted as specified in Section 2220, Earthwork and ready to support paving and imposed loads.

B. Verify that grades and elevations are as indicated on the plans.

3.2 SUBGRADE

A. The subgrade surface shall be cut, filled and compacted as required to achieve the lines, grades and cross sections shown on the plans within a tolerance of 1/4 inch from plan elevation.

B. The top six (6) inches of the subgrade shall be compacted to 95 percent of the maximum density as specified in ASTM D-698 with a moisture content ranging from plus 2 to minus 3 percent of optimum.

C. If the subgrade cannot be properly compacted remove soft material, replace with suitable fill material and compact to 95 percent standard maximum density

D. Protect the finished subgrade from any damage, erosion or settlement until pavement placement. Any areas which are damaged shall be repaired to the specified lines, grades and cross sections. Any subgrade which has become unacceptable shall be reworked and restored to the lines, grades and density specified.

3.3 AGGREGATE BASE COURSE

A. Verify that the subgrade has been graded and compacted as specified.

B. Place aggregate base course to the width and thickness indicated in the plans. The material shall be uniformly spread in successive layers to achieve the specified depth, but in no case shall any

individual layer have a compacted thickness greater than 4 inches. Each layer shall be compacted to a least 95 percent maximum density, according to ASTM D-698, prior to placing any additional material.

C. After spreading, the aggregate shall be kept at the proper moisture content to insure the specified compaction. Water shall be added and uniformly mixed in such a manner to prevent segregation. Excess moisture creating runoff shall be avoided. If the aggregate and subgrade become too wet for proper work and compaction, the materials shall be allowed to dry sufficiently.

D. Work causing segregation of the aggregate is not permitted. If segregation of the aggregate in excess of 10 percent variation from the specified gradation or if the materials become contaminated, the segregated and contaminated material shall be removed and replaced with suitable material at the Contractor's expense. The in-place gradation shall be tested by a sieve analysis using a minimum of 100 pounds of in-place base course. If crushed stone is used, the segregated surface areas may be corrected by adding limestone screens of the gradation and quantity required to fill the surface voids and create a firmly bound material.

E. Shape and compact the aggregate base continuously until the proper grade, cross section and specified density have been obtained. Final rolling shall be performed with a self-propelled smooth wheeled roller.

3.4 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Verify that manholes, inlets or any other structures have been brought to the proper elevation, grade and alignment prior to placing concrete. Coat surfaces of manholes; curb inlets, existing structures and frames with oil to prevent bonding with concrete.

C. Notify Engineer a minimum of 24 hours prior to commencement of concreting operations.

3.5 FORMING

A. Place and secure forms true to line and grade. Forms shall be supported throughout their length and joined in a manner to prevent movement in any direction.

B. Clean and lubricate forms prior to each use. Forms shall be assembled to permit easy removal without damage to the new concrete.

C. Place joint filler vertical in position, in straight lines as specified below. Secure to formwork during concrete placement.

3.6 REINFORCEMENT

A. Place reinforcement as indicated in the details and typical sections in the plans.

B. Interrupt reinforcement at expansion joints.

3.7 PLACING CONCRETE

A. Concrete shall be placed in accordance with MCIB Standard Concrete Specifications.

B. Concrete shall not be placed on subgrade or base which is muddy or frozen.

C. Concrete shall be placed in such a manner to minimize segregation.

D. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

E. Deposit concrete on the subgrade or base to the required depth and lane width indicated on the plans. Place concrete continuously between predetermined construction joints in successive batches without using intermediate forms or bulkheads. The concrete shall be placed as closely to its final position as possible in order to minimize the amount of additional spreading necessary.

F. Care shall be taken to deposit a sufficient volume of concrete along joints and forms. Curbs constructed of MCIB Mix No. WA-610-1-4 concrete shall be mechanically vibrated.

G. If curbs are poured simultaneously with pavement, deposit an ample amount of concrete along the outside form line to consolidate and finish curbs as required.

H. During placement, vibrate and compact concrete with the appropriate tools and equipment to prevent voids and honeycomb pockets. Vibration is not required for placement of concrete for sidewalks and driveways.

I. Construct integral curb where indicated on the plans.
   1. Construct integral curb immediately following concrete pavement finishing. Pavement and curb construction shall be carefully coordinated to prevent forming of "cold joints".
   2. Steel curb forms shall be used for integral curb except where small radii or special sections prevent their use.
   3. During curb placement, sufficiently spade concrete to secure an adequate bond with the pavement and eliminate voids.
   4. Curbs shall be constructed to the cross section shown in the details with templates supported on the side forms and with a float not less than four feet long.

J. Concrete shall not be allowed to extrude below the forms.

3.8 PAVEMENTS JOINTS

A. Joints shall be formed at right angles to the alignment of the pavement to the depth and configuration shown in the details on the plans.

B. Expansion joints shall be placed at locations shown or noted on the plans.
   1. Expansion joints shall extend the entire width of the pavement and from the subgrade to one inch below the pavement surface or the material will have a suitable tear strip provided to

allow for application of joint sealer.

2. Under no circumstances shall any concrete be left across the expansion joint.
3. Expansion joints shall be formed using a one piece; one inch thick preformed joint filler cut to the configuration of the pavement section.
4. Expansion joints shall be secured to prevent any displacement during concrete placement, consolidation and finishing.
5. If dowels are specified for the expansion joint the dowel shall be firmly supported with a dowel basket. One half of each dowel shall be painted, greased or fitted with a dowel sleeve as shown in the details.

C. Contraction joints shall be located as indicated in the plans according to one of the following methods.

1. Contraction joints may be formed with templates. The template shall remain in place until the concrete has achieved its initial set and is finished as for tooling joints.
2. Sawed contraction joints shall be cut as soon as the concrete is hard enough to not be torn or damaged by the blade. Contraction joints shall be sawed to a minimum of 1/4 the pavement thickness. Any joint sawing which results in premature or uncontrolled cracking shall be discontinued and the time interval between cutting and sawing adjusted.
3. Contraction joints may be tooled to conform to the width and depth shown in the details and to 1/4 the slab depth.
4. Pre-molded strips may be used to form the contraction joint. The strips shall be the depth and width indicated in the details and inserted at the joint location after the concrete has been bull-floated. Secure the strip so as not to be disturbed during finishing.
5. If dowels are required in contraction joints, they shall be of the size and type specified. Dowels shall be firmly supported in place and aligned parallel to the pavement line and grade.

D. Longitudinal and construction joints shall be placed as shown on the plans or where the Contractor's construction operations dictate.

1. Longitudinal center joints shall be constructed as specified for contraction joints.
2. Longitudinal construction joints between lanes shall be keyed joints according to the dimensions in the details.
3. Traverse construction joints as shown in the details shall be placed wherever concrete placement is suspended for more than 30 minutes.
4. Tiebars used in construction joints shall be deformed steel of the size and type indicated in the detail. Tiebars shall be spaced as noted on the plans and secured to prevent being disturbed during construction.

3.9 CURB JOINTS

A. Joints shall be formed at right angles to the alignment of the curb as specified in plans

B. Expansion joints shall be placed at all radius points, driveways, curb inlets and any additional locations directed by the Engineer.

1. Expansion joints shall be formed using a one piece; 3/4 inch thick preformed joint filler cut to the configuration of the curb section.
2. Expansion joint material shall be secured to prevent any displacement during concrete placement, consolidation and finishing.

3. Joint edges shall be rounded with a 1/4 inch radius edging tool.

C. Curbs shall have one inch deep contraction joints at intervals of not less than 10 feet and not greater than 20 feet. The contraction joints shall extend across the entire curb section to one inch below the pavement surface and may be formed by one of the following methods.
   1. Contraction joints may be formed using a 1/8 inch metal template cut to the configuration of the curb section. Secure templates in place to prevent them from being disturbed. The templates shall remain in place until the concrete has attained its initial set and finishing is completed.
   2. Contraction joints may be tooled to the specified depth. All exposed joint edges shall be given a 1/4 inch radius.
   3. Sawed contraction joints may be cut when a curb machine has been used. Joints must be sawed within 24 hours of curb placement.
   4. Joint sealer is not required for contraction joints.

3.10 SIDEWALK AND DRIVEWAY JOINTS

A. Joints shall be formed at right angles to the alignment of the sidewalk and driveway according to the details in the plans.

B. Sidewalks shall have traverse joints spaced at a distance equal to the sidewalk width. Sidewalks greater than 6 feet in width shall be divided by longitudinal joints spaced not less than 30 inches or greater than 48 inches with the traverse joints at the same spacing to form a square pattern.

C. Driveways wider than 20 feet shall have a traverse joint in the center.

D. Expansion joints shall be located as indication in the details.
   1. Expansion joints shall be formed using a one piece; 1/2 inch thick preformed joint filler cut to match the cross section of the sidewalk or driveway. The joint material shall be left 1/2 inch below the pavement surface or a tear strip provided to allow for application of joint sealer.
   2. Secure joint material to prevent any displacement during concrete placement, consolidation and finishing.
   3. Round joint edges with a 1/4 inch radius edging tool.

E. Contraction joints for sidewalks and driveways shall be one inch deep and 1/8 inch wide with edges rounded by a 1/4 inch radius edging tool. The edger marks shall be left on all sidewalks and driveways.
   1. Contraction joints may be sawed with the approval of the Engineer.
   2. Joint sealer is not required for contraction joints.

3.11 PAVEMENT FINISHING

A. Concrete pavement shall be struck off and consolidated using mechanical finishing machine or hand methods.

B. When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing the pavement conforms to the exact elevations shown on the

plans.

C. When hand finishing methods are used, the pavement shall be struck off and consolidated by a vibrating screed to the exact elevations shown on the plans. Internal mechanical vibrators shall be used along all formed surfaces.

D. After concrete has been struck off and consolidated, it shall be smoothed using a mechanical longitudinal float or a longitudinal hand float. The float shall be a minimum of 12 feet long and 6 inches wide. Longitudinal floating may be eliminated if the specified tolerances can be achieved by other approved methods.

E. If floating has been eliminated the pavement shall be scraped with a 10 feet long straight edge. Any excess water and laitence shall be removed from the pavement surface by the straight edge. After scraping, the pavement shall meet the specified tolerances.

F. While the concrete is still plastic, the surface shall be tested for smoothness using a 10 foot straight edge with handles 3 feet longer than one-half the slab width. The straight edge shall be placed parallel to the centerline and the surface tested at 5 foot intervals across the pavement. After each test the straight edge shall be moved forward 1/2 its length and the operation repeated. All irregularities shall be repaired by adding or removing concrete and smoothing with a float of a minimum of 3 feet long and 6 inches wide and straight edged again. The pavement surface shall have no depressions which hold water.

G. Before concrete has achieved initial set and prior to final finishing, the edges of the slab and curb shall be finished with an edger of the radius shown in the details.

H. Concrete pavement shall have a burlap drag or broom finish. The curb shall have the same finish as the pavement.

3.12 CURB, SIDEWALK AND DRIVEWAY FINISHING

A. After placement and initial strike-off, the edges and curb shall be tooled to the radii shown in the details. If the surface is wet enough to create a ridge at the inside of the radius tool, finishing will be discontinued until the excess moisture evaporates.

B. After the concrete has achieved initial set, face forms and templates shall be removed and the surface finished to the required dimensions. No water, dryer or additional mortar shall be applied to the concrete.

C. After finishing, the surface of the concrete shall be broomed with a fine clean broom. The edges and joints of sidewalk and driveways shall be retooled. Finished curb, sidewalk and driveway shall have a true surface, free of sags, twists or warps and shall be uniform in color and appearance.

3.13 CURING

A. Concrete curing shall conform to MCIB Standard Concrete Specifications except that water proof paper or polyethylene sheeting, wet burlap and cotton mats are not acceptable curing methods for

concrete pavement, curbs, sidewalk and drives.

B. As soon as practical after finishing and not later than one hour following placement, the concrete shall be cured by one of the acceptable liquid curing membranes, applied according to the manufacturer's instructions.

C. If the forms are removed within 72 hours after placing concrete, or if a slip form paving machine or curb machine are used these surfaces shall also be cured.

3.14 PROTECTION

A. The Contractor shall protect concrete work from damage or defacement until accepted by the Owner. Any concrete which has been damaged or defaced shall be removed and replaced or repaired to the Engineer's satisfaction at the Contract expense.

B. All concrete pavement shall be protected from vehicular traffic until it has achieved 70 percent of the 28 day compressive design strength.

3.15 JOINT SEALING

A. All pavement joints and sidewalk and driveway expansion joints shall be sealed with a specified joint sealer within 7 days of concrete placement. Pavement joints shall be sealed prior to being opened to vehicular traffic. Only the sidewalk portion of the curb requires joint sealing with a specified joint sealer within 7 days of placement.

3.16 TOLERANCE

A. Surface tolerance for all concrete work shall be 1/4 inch in 10 feet, in all directions, when checked with a 10 foot straight edge.

3.17 BACKFILL

A. Concrete forms shall remain in place a minimum of 24 hours. Curbs, sidewalks and driveways may be backfilled immediately after forms are removed. Concrete pavement shall not be backfilled within 5 days of concrete placement.

B. Backfill concrete work with suitable fill material compacted to 90 percent maximum density.

3.18 CLEAN UP

A. The Contractor shall be responsible for removal from the site of excess concrete, rock, dirt, debris and any broken concrete. Clean up shall take place as work progresses.

B. Contractor shall be responsible for the repair of any existing pavement, curb, sidewalk or driveway damaged or disturbed during construction to the satisfaction of the Engineer.

3.19 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

END OF SECTION

SECTION 02580 -PAVEMENT MARKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Traffic marking paint.

1.2 REFERENCES

A. M-248: AASHTO Specification for Ready Mixed White and Yellow Traffic Paint.

B. M-247: AASHTO Specification for Glass Beads used in Traffic Paint.

1.3 SUBMITTALS

A. Submit under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

PART 2 PRODUCTS

2.1 TRAFFIC MARKING PAINT MATERIALS

A. Pavement Marking Lines: Pavement marking material shall conform to the requirements of Type S, N, or F traffic paints as described in the AASHTO Specification M-248-86, Ready-Mixed White or Yellow Traffic Paints. Reflectorizing material shall be reflective spheres conforming to the requirements of Type 1 beads as described in AASHTO Specification M-247, Glass Beads used in Traffic Paint.

B. Pavement Marking Symbols: At the Contractors option, preformed marking tape may be used in place of traffic paint for pavement marking symbols. Preformed marking tape shall meet the requirements of MHTD Specification 1048.2, Type 1 Preformed Marking Tape.

PART 3 EXECUTION

3.1 APPLICATION

A. All pavement marking lines and symbols shall be according to the dimensions and layout in the plans.

B. The markings shall be applied to a clean, dry surface. The markings shall be applied using a mechanically self-propelled striping unit. Pavement marking lines shall be 4 inches wide and 12 to 15 mils thick when dry. The lines shall be reflectorized using drop-on reflective spheres.

C. The Contractor shall protect the newly applied striping with cones or other barriers until the markings are dry and tract free.

3.2 FIELD QUALITY CONTROL

A. Field testing and inspection will be performed under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

END OF SECTION

SECTION 02722 - STORM DRAINAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Storm Drainage Piping.

B. Curb Inlet, Field Inlet, and Junction Box

C. PVC Sewer Pipe for Roof Drains

1.2 REFERENCES

A. Midwest Concrete Industry Board (MCIB) Standard Specification for Concrete Work.

B. ASTM C-76: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. ASTM C-443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

D. ASTM D-698: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

E. ASTM D-1557: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

F. ASTM D-2922: Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D-3017: Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Submit under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Product Data and Shop Drawings: Provide data indicating pipe, pipe accessories, curb inlets, field inlets, manholes Junction Box.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.2 PROJECT RECORD DOCUMENTS

A. Submit under provisions setforth in the General and Special Conditions and Division 1 of these specifications.

B. Accurately record actual locations of pipe runs, connections, inlets, manholes, invert elevations and pipe sizes.

C. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated on the plans.

1.9 COORDINATION

A. Coordinate the storm sewer construction with other work.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Reinforced Concrete Pipe (RCP): Reinforced concrete pipe shall be Class III with wall Type B, and conform to ASTM C-76.

B. Reinforced Concrete Pipe Joint Device:
   1. Flexible Gasket: All flexible gaskets shall conform to ASTM C-443. Flexible gaskets may be flat gaskets cemented to the pipe spigot, O-ring gaskets, or roll-on gaskets.
   2. Cement Mortar: Cement mortar gaskets shall be one part Type I Portland cement by volume to three parts sand conforming to ASTM C-144 by volume. Mix with sufficient water to form a workable stiff mortar paste.
   3. Plastic compound: A homogeneous blend of bituminous material, inert filler and suitable solvents or plasticizing compounds. Compound shall be thoroughly mixed at the factory to a uniform consistency suitable for sealing concrete pipe joints. Plastic compound shall conform to the following requirements:
      a. Bitumin, Soluble in CS_2, percent by weight, 45% minimum.
      b. Ash, 15 - 50 percent by weight.
      c. Penetration, Standard cone, 150g
         5 seconds, 25□ C
         Trowel grade, bulk type 110-250 mm
         Extruded rope or flat type 50-120 mm
   4. Preformed Plastic Compound: Preformed plastic compound shall be in either rope or flat tape form conforming to Federal Specification SS-S-210A. Primer shall be used to maintain material position while pipe sections are being joined.

C. Reinforced Concrete Pipe End Sections: RCP end sections shall be the pipe manufacturer's standard design flared end section, conforming to ASTM C-76, Class III.

D. Poly Vinyl Chloride (PVC) Sewer Pipe: Poly vinyl chloride sewer pipe shall conform to ASTM D-3034 and have a minimum wall thickness conforming to SDR 35 (26, 21) as indicated in the plans.
   1. The Contractor shall install the maximum pipe lengths manufactured by the supplier. The pipe bedding shall conform to ASTM D-2321 for class I materials.
   2. Flexible gasketed joints for PVC pipe and fittings shall be compression type joints with the gasket confined in either the spigot or the bell end of the pipe. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM D-1869. Natural rubber gaskets will not be acceptable.
   3. Fittings for PVC sewer pipe such as tee connections shall be saddle type fittings of PVC Plastic.

2.2 GRANULAR BEDDING MATERIAL

A. Granular bedding material shall be 3/8 inch crushed, clean limestone aggregate with the following gradation:

Sieve Size	Percent Passing
3/8"	100
No. 4	30 - 45
No. 10	0 - 4

2.3 CURB INLET

A. Curb Inlets shall conform to Detail in the plans

2.4 FIELD INLET

A. Field inlet shall conform to Detail in the plans

2.5 JUNCTION BOX

A. Junction Box shall conform to Detail in the plans

2.6 CEMENT MORTAR

A. Cement mortar shall be pre-mix mortar non-shrink or expansive grout consisting of one part Portland cement and two parts sand by volume mixed with sufficient water to form a workable stiff grout for packing pipe openings in structures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that dimensions and elevations as indicated in the plans.

3.2 PROTECTION

A. Contractor shall take whatever means necessary to protect existing structures or utilities on or adjacent to the site from damage or displacement. Any such structures or utilities which are damaged or displaced shall be repaired at the Contractor's expense.

B. Locate, identify and protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or neglectful actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

C. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

D. Protect trees, plant growth and features designated to remain as final landscaping.

E. Protect all property or lot corner pins and stakes from damage or displacement. If property or lot corner markers must be moved, they shall be properly referenced prior to removal and reset by the Contractor upon completion of the project.

F. Protect from damage or displacement all project benchmarks and existing structures within or adjacent to the construction limits that are not to be removed or demolished.

3.3 TRENCHING

A. All storm sewer excavation shall be open cut. The Contractor shall not open more trench in advance of the pipe laying than is necessary. The length of open trench shall be limited depending on the nature of the soil and safety considerations. All open trenches shall be adequately protected.

B. All excavation shall be unclassified. No separate payment will be made for rock. Unclassified excavation shall be defined as the removal of all material encountered regardless of its nature.

C. Excavate trenches to a width which provides adequate working space and pipe clearance for proper installation, jointing and embedment.

D. When unstable or unsuitable material is encountered in the trench subgrade, such material shall be removed, backfilled with granular pipe embedment material and compact to the density equal to or greater than required for subsequent backfill material.

E. Hand trim for bell and spigot pipe joints. Remove loose material.

F. The Contractor shall sort and stockpile excavated material so that suitable material is available for backfill. Excavated material shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material not used for backfill shall be removed from the site.

G. The Contractor shall remove any water which may accumulate in the trenches. The Contractor shall form dams, flumes or other means necessary to keep trenches clear of water while storm sewers are being constructed. All water shall be removed in a manner to not damage property or other work.

H. Depth and width of structure excavation shall be as required for proper installation, pipe connection and inspection. Over excavation due to unstable subgrade material shall be backfilled with granular bedding material.

I. Over excavation due to Contractor's oversight shall be backfilled with granular bedding material as required at no additional cost to the Owner.

3.4 BEDDING

A. Bedding and backfill for storm sewer pipe trenches shall be according to the storm sewer bedding and trenching details in the plans.

B. Consolidate granular bedding by rodding, spading and compacting as necessary to provide uniform support for pipe.

C. Place bedding material at trench bottom. Level materials in continuous layers not exceeding 6 inches compacted depth. Compact to 95 percent maximum density.

D. Bedding for precast concrete box culverts shall be a 4 inch course of untreated compacted aggregate, extending one foot past the exterior face of the box.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 PIPE INSTALLATION

A. All pipe shall be protected during installation from shock and freefall. Pipes shall be installed without cracking, chipping, breaking, bending, or damaging the materials. Damaged pipe shall be replaced with new materials except when repairs are permitted by the Owner.

B. All shoring, bracing or blocking, shall be furnished and installed as necessary to preserve and maintain exposed excavation faces, protect the proposed pipeline and provide for safety. Shoring or other methods for support of trench walls is the responsibility of the Contractor and shall be so done by methods which will not adversely affect pipeline alignment, grade and structural integrity. All bracing, sheeting and/or shoring installed below a horizontal plane six inches (6") above top of proposed pipe, shall not be disturbed or removed after pipe and/or pipe embedment has been installed, unless otherwise specified. The bottom skids of a trench-shield shall not extend lower than six inches (6") above top of proposed pipe. No sheeting or bracing shall be left in place within 5 feet of the surface without written permission from the Engineer.

C. Lay pipe beginning with the lowest point. Install pipe with the bell or groove end upgrade. All pipe shall be laid with ends abutting and true to line and grade.

D. Lay pipe to the line and grades indicated on the plans with a maximum variation from the true slope of 0.1 inch in 10 feet, but no greater than 0.1 foot variance in flowline elevation at the structure. The Contractor shall establish such grade control devices necessary to maintain the specified tolerance. All pipe shall have a continuous slope free of depressions.

E. Prior to applying any joint material, the joint surfaces shall be cleaned and dried.

F. For flexible gaskets used for concrete pipe joints, flat gaskets may be cemented to the pipe spigot or tongue. O-ring gaskets shall be recessed in a groove on the pipe spigot or tongue and confined by the bell after the joint is completed. Roll-on gaskets shall be placed around the spigot or tongue and rolled into position as the joint is assembled. Flat and O-ring gaskets shall be lubricated as recommended by the manufacturer.

G. Plastic joint sealant used for jointing concrete pipes shall be applied to the tongue or spigot prior to insertion into the groove or bell. A sufficient amount of sealant shall be used to fill the joint space with some squeeze out. Apply additional joint material to the exterior of the joint to assure a complete seal.

H. The joint surfaces of concrete pipes jointed with cement mortar shall be cleaned and soaked with water immediately before jointing. After installation of the pipe sections, a layer of mortar shall be placed in the bell or groove, completely filling the joint space, and to the spigot or tongue of the pipe to be installed. The tongue or spigot shall then be inserted into the groove or bell until the mortar squeezes out on both the interior and exterior surfaces.

I. No pipe may be trimmed without the approval of the Engineer. Any pipe with defects which do not cause its rejection shall be laid so that the defect has the least consequence on the storm sewer system.

J. The Contractor shall keep the trenches free of water and as dry as possible during laying, bedding and jointing operations until joints and concrete in structures are sufficiently cured.

K. Pipes connecting to structures shall be cut parallel with the inside face for structures with plane walls and cut parallel with the spring line of the pipe for structures with curved walls. Projection of the pipe beyond the inside face shall not exceed one inch.

L. Flared end sections for RCP, shall be placed centered, on a concrete toe wall. The toe wall shall be 8 inches thick, 24 inches deep and the width of the flare of the end section.

3.6 PRECAST STRUCTURE INSTALLATION

A. Curb inlets, Field Inlet and Junction Box shall be inspected upon delivery. Rejection of defective or cracked components shall be in accordance with ASTM C-478.

B. Form bottom of excavation clean and smooth to correct elevation.

C. At the Contractor's option, concrete base slabs for precast structures may be cast-in-place. Place or form and pour the base slab to the proper elevations.

D. Level top surface of base pad to receive concrete structure sections, with blockouts to receive storm sewer pipe sections.

E. Establish elevations and pipe inverts for inlets and outlets as indicated in the plans.

F. Curb inlet, Field Inlets and Junction Box Sections shall be placed to the elevation and alignment indicated on the plans. Lift holes shall be patched with non-shrink grout.

G. Form concrete invert in structures to make changes in direction of flow with smooth curves of as large a radius as permitted by the inside dimension of the structure. Grade changes and transitions shall be smooth and uniform. All parts of the invert channel and adjacent floor shall slope to drain. Invert channels for precast structures may be cast integrally with the structure base slab.

H. Verify structure top elevation prior to placing top.

I. Manhole steps shall be aligned with the ring and cover and placed at 16 inch centers in structures exceeding 4 feet in depth.

3.7 BACKFILL

A. Earth fill used as backfill material shall be excavated material entirely imperishable containing no muck, frozen material, organic material, rocks larger than 6 inches in diameter and rubbish which could damage the pipe.

B. All trash and debris shall be removed from the trench prior to backfilling.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy surfaces.

D. Do not backfill when material is frozen or contains frost or snow.

E. Place granular bedding material to the spring line of the pipe and, at the Contractor's option,may be placed to a point 12 inches above the top of the pipe. Place in six inch maximum lifts compacted to 95 percent maximum density. Compact by rodding, spading or vibrating to provide uniform contact with pipe and trench to prevent settlement or displacement.

F. Backfill trenches to the contours and elevations shown in the plans. Place backfill material from the springs line of the pipe or from 12 inches above the top of pipe to subgrade to allow for placement of pavement or top soil as required. Place backfill in lifts not to exceed 6 inches in loose thickness. Each lift shall be compacted to 95 percent of maximum density with a moisture content ranging from minus 2 percent to plus 2 percent of optimum according to ASTM D-698 prior to placement of additional lifts.

G. Place and compact backfill material carefully to avoid damage or displacement of the pipe and other exposed utilities.

H. Backfill around structures shall be as specified for adjacent trenches. The Contractor shall employ a placement and compaction method which will not create any wedging action between the side of the excavation and the structure that would cause any movement of the structure. Any damage caused by unbalance backfill or use of equipment on or near a structure shall be the Contractor's responsibility.

I. Backfill shall be placed and compacted on all sides of the structure simultaneously. Conduct operations so that the backfill is always at approximately the same elevation on all sides.

J. No rock larger than 4 inches maximum dimension shall be placed within one foot of the exterior surface of a structure.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Work within the public right-of-way is subject to inspection by the Public Works Department.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.9 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

B. Protect finished Work from damage or displacement until accepted by the City.

END OF SECTION

SECTION 02830 - CHAIN LINK FENCES

PART 1 GENERAL

1.1 SUMMARY

A. Provide chain link fence system around entire perimeter of parking lot, as shown on the drawings and specified herein and as needed for a complete and proper installation.

B. Chain link fence system shall consist of an 8’ high fence with angled, 3-strand barb wire top.

C. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. General: Submit the following according to conditions of the Contract and Division 1 Specification Sections.

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B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this Section with the work of adjacent trades;
4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 PRODUCTS

2.1 DIMENSIONAL DATA

A. General:
1. Pipe sizes indicated are commercial pipe sizes.
2. Tube sizes indicated are nominal outside dimensions.
3. H-section sizes indicated are normal flange dimensions.
4. Roll-formed section sizes indicated are the nominal outside dimensions.

2.2 GALVANIZING

A. On steel framework and appurtenances, provide galvanized finish with not less than the following weight of zinc per sq ft.
1. Pipe: 1.8 oz, complying with ASTM A120.
2. H-sections and square tubing: 2.0 oz, complying with ASTM A123.
3. Hardware and accessories: Comply with Table I of ASTM A153.
4. Fabric: 2.0 oz, complying with class II of ASTM A121.

2.3 FABRIC

A. Provide number 9 gauge or 0.148" wires in 2" mesh, with top and bottom selvages twisted and barbed.

B. Provide fabric in one-piece widths.

2.4 POSTS, RAILS AND ASSOCIATED ITEMS

A. End, corner, slope and pull posts: Provide at least the following minimum sizes and weights:

Material and dimensions:	Lbs per linear ft:
Pipe, 2.875" O.D.	5.79
Tubing, 2-1/2" square:	5.70
Roll-formed section, 3-1/2" x 3-1/2":	5.14

B. Line posts: Provide minimum sizes and weights as follow:

Material and dimensions:	Lbs per linear ft:
Pipe, 2.375" O.D.	3.65
H-section, 2.25" x 1.95 x 0.143	1.95

C. Gate posts: Provide gateposts for supporting single gate leaf or one leaf of a double gate
installation, for nominal gate widths as follows:

Materials and dimension:	Lbs per linear ft:
Pipe, 4" outside dimension:	9.10
Tubing, 3" square:	9.10
H-section, 4":	14.00

1. Over 13 feet wide, and up to 18 feet wide: Use 6.625" outside diameter pipe weight in 14.0 lbs per linear ft.
2. Over 18 feet wide: Use 8.625" outside diameter pipe weighting 24.70

lbs per linear ft.

D. Top rails:
1. Use 1.660" outside diameter pipe weighing 1.80 lbs per linear ft; or
2. Use 1.625" x 1.25" roll-formed sections weighing 1.35 lbs per linear ft.
3. Provide in manufacturer's longest lengths, with expansion type couplings approximately 6" long for each joint.
4. Provide means for attaching top rail securely to each gate, corner, pull, slope and end post.

E. Post brace assemblies:
1. Provide at end and gate posts, and at both sides of corner, slope and pull posts, with the horizontal brace located at mid-height of the fabric.
2. Use 1.660" outside diameter pipe weighing 1.80 lbs per linear ft for horizontal brace.
3. Use 3/8" diameter rod with turnbuckle for diagonal truss.

F. Tension wire:
1. Provide number 7 gauge galvanized coiled spring wire at bottom of fabric.

G. Post tops:
1. Provide steel, wrought iron or malleable iron, designed as weather tight closure cap.
2. Provide one cap for each post.
3. Provide caps with openings to permit through passage of top rail.

H. Stretcher bars:
1. Provide one-piece lengths equal to full height of fabric, with a minimum cross-section of 3/16" x 3/4".
2. Provide one stretcher bar for each gate and end post and two for each corner, slope and pull post, except where fabric is woven integrally into the post.

I. Stretcher bar bands:
1. Provide steel, wrought iron, or malleable iron, spaced not over 15" on centers, to secure stretcher bars to end, corner, pull, slope and gate posts.
2. Bands may be used also with special fittings for securing rails to end, corner, pull, slope and gate posts.

2.5 GATES

A. General:
1. Fabricate gate perimeter frames of tubular members.
2. Provide additional horizontal and vertical members to assure proper operation of the gate, and for attachment of fabric, hardware and accessories.
3. Space so frame members are not more than 8 feet apart.
4. Fabricate gate frames from:

Material and dimensions:	Lbs per linear ft:
Pipe 1.90" outside diameter:	2.72
Tubing, 2" square:	2.60

B. Fabrication:
1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
2. Use same fabric as used in the fence.
3. Install fabric with stretcher bars at vertical edges as a minimum.
4. Attach hardware with rivets or by other means that will provide security against removal and breakage.

C. Gates:

1. Sliding Gates: Sliding gates shall conform to the requirements of ASTM F 1184.
   a. Cantilever Slide Gates: Provide manufacturer's standard top rail incorporating track for top roller guideposts to keep gate on rollers. External rollers shall have ungreased fittings; internal rollers shall have sealed lubricant ball bearings. Gates shall be manufactured to prevent sagging. Fabric shall be the same size and finish as the fence and shall be applied to the entire gate. Provide a lockable positive latch and other hardware and accessories as required. Provide 16' gate.

2.6 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Wire ties:
1. For tying fabric to line posts, use number 9-gauge wire ties spaced 12" on centers.
2. For tying fabric to rails and braces, use number 9-gauge wire ties spaced 24" on centers.
3. For tying fabric to tension wire, use number 11 gage hog rings spaced 24" on centers.
4. Manufacturer's standard wire ties will be acceptable if of equal strength and durability.

B. Concrete: Comply with provisions of Section 03300 for 2500 psi concrete.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install posts at a maximum spacing of 10 feet on centers.
2. Install corner or slope posts where changes in line or grade exceed a 30-degree deflection.

B. Excavating:
1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
2. Post hole dimensions:
   a. Provide 30" deep by 8" diameter foundations for line posts for 5-foot fabric height and less.
   b. Provide 36" deep by 8" diameter foundations for line posts for fabric heights exceeding 5 feet.
   c. Provide 36" deep by 12" diameter foundations for all other posts.
3. Spread soil from excavations uniformly adjacent to the fence line or on adjacent areas of the site if so directed.
4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.
5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified above.

C. Setting posts:
1. Remove loose and foreign materials from sides and bottoms of holes and moisten soil prior to placing concrete.
2. Center and align posts in holes.
3. Place concrete around posts in a continuous pour and vibrate or tamp for consolidation.
4. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
5. Trowel tops of footings, and slope or dome to direct water away from posts.
6. Extend footings for gateposts to the underside of bottom hinge.
7. Set keeps, stops, sleeves and other accessories into concrete as required.
8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method approved by the Architect.
9. Gout-in those posts that are set into sleeved holes, concrete constructions or rock excavations, using non-shrink Portland cement grout or other grouting material approved by the Architect.

D. Concrete strength:
1. Allow concrete to attain at least 75% of its minimum 28-day strength before rails, tension wires and/or fabric is installed.
2. Do not, in any case, install such items in less than seven days after placement of concrete.
3. Do not stretch and tension fabric and wire and do not hang gates, until concrete has attained its full design strength.

E. Rails and bracing:
   1. Install fence with a top rail and bottom tension wire.
   2. Install top rails continuously through post caps or extension arms, bending to radius for curved runs.
   3. Provide expansion couplings as recommended by the fencing manufacturer.
   4. Provide bracing to the midpoint of the nearest line post or posts at all end, corner, slope, pull and gate posts.
   5. Install tension wires parallel to the line of fabric by weaving through the fabric and tying to each post with not less than number 6 gage galvanized wire or by securing the wire to the fabric.

F. Installing fabric:
   1. Leave approximately 2" between finish grade and bottom selvage.
   2. Excavate high points in the ground to clear the bottom of the fence.
   3. Place and compact fill to within 1" of the bottom of the fabric in depressions.
   4. Pull fabric taut and tie to posts, rails, and tension wires.
   5. Install fabric on outward side facing side of fence, and anchor to framework so that the fabric remains in tension after pulling force is removed.
   6. Install stretcher bars by threading through or clamping to fabric on 4" centers and secure to posts with metal bands spaced 15" on centers.

G. Installing gates:
   1. Install gates plumb, level and secure for full opening without interference.
   2. Install ground-set items in concrete for anchorage in accordance with the fence Manufacturer's recommendations as approved by the Architect.
   3. Lubricate and adjust the hardware for smooth operation.

H. Miscellaneous:
   1. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
   2. Bend ends of wire to minimize hazards to persons and clothing.
   3. Fasteners:
      a. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
      b. Peen the ends of bolts to prevent removal of nuts.
   4. Repair coatings damaged in the shop of field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as approved by the Architect.

END OF SECTION

SECTION 02923 - TOPSOIL MATERIAL AND APPLICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Final grade topsoil for shrub beds, ground cover beds, and lawn areas.

1.2 RELATED SECTIONS

A. Section 02923 - Topsoil material and application.

B. Section 02950 – Trees, Shrubs, & Groundcovers

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil: On-site or imported topsoil shall be used for turf and shrub bed areas. All topsoil shall be a friable, loamy mixture and of similar texture to the project site soil type to the satisfaction and approval of the Architect. It shall not have a mixture of subsoil and contain no slag, cinders, stones, lumps of soil, sticks, roots, trash or other extraneous materials larger than 1-1/2 inches in diameter. Topsoil must also be free of plants or plant parts of common bermuda-grass, johnsongrass, nutsedge, poison ivy, canada thistle, or others as specified. The Contractor shall have topsoil tested by a reputable laboratory for Cation Exchange Capacity (CEC), pH and essential macro nutrients. If needed, pH correction material shall be applied at a rate sufficient to correct the pH to a range of 6.0-7.0. Topsoil imported from off-site shall meet the standards set forth in Section 11-1, paragraph B of the Midwest Turfgrass Growers Association standard specification.

1. No plant material shall be planted in soil that has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. The Contractor shall assume full responsibility for any loss or damage to the plants arising from improper use of chemicals or due to his failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

2.2 TESTS

A. The Contractor shall be responsible for providing physical and fertility analysis of topsoil.

B. Have soil lab analyze topsoil to ascertain; Cation Exchange Capacity, percentage of essential primary macronutrients (nitrogen, phosphorus, and potassium), and pH value.

C. Testing for on-site or imported topsoil is not required if the tests specified were conducted within the last 12 months. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability and fertility requirements for turf, shrubs and trees.

D. Submit both the physical and fertility analysis results to the Architect. The topsoil fertility test results shall be used by the Contractor for modifying the proposed fertilizer application rates for the following applications:
   1. Proposed Regular Sod and Seed Areas.
   2. Proposed Sports Field Areas.

PART 3 EXECUTION

3.1 EXAMINATION

D. Before all work in this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   1. In case of discrepancy, immediately notify the Architect.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

E. Verify substrate base has been contoured and compacted.

F. Weeds that have emerged or persisted shall be removed or eradicated with an acceptable post-emergent herbicide that is approved in writing by the Architect.

G. The Contractor shall verify that all turf areas to receive topsoil have been graded to a minimum slope of 2% before beginning work of this section.

H. The Contractor acknowledges his acceptance of previous related work at the time he proceeds with the work of this specification Section.

3.2 SUBSTRATE PREPARATION

I. Scarify subgrade to a minimum depth of 4-inches where topsoil is scheduled. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

J. Remove stones, sticks, debris, roots, branches, and other extraneous matter measuring over 1-1/2 inches in any dimension.

K. Eliminate uneven areas and low spots.

L. Limit preparation to areas that will be planted promptly after preparation.

3.3 PLACING TOPSOIL

M. Place topsoil in turf, ground cover, and shrub areas at the minimum thickness indicated in the schedule on Page 02923-3.
   1. Spread topsoil to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement. Rake until smooth.
   2. Place approximately ½ the total amount of topsoil required. Work into top of loosened

subgrade to create a transition layer and then place remainder of planting soil.

N. Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading.

O. Fine grade topsoil eliminating rough or low areas. Maintain profiles and contour of subgrade.

P. Remove roots, weeds, rocks and foreign material while spreading.

Q Compact placed topsoil to 85 percent standard proctor density.

R Remove surplus subsoil from the site. Surplus topsoil shall be wasted on the site at a location designated by the Architect.

S Leave stockpile area and site clean and raked, ready to receive seeding. Stockpile area shall be a location designated by the Architect.

3.4 GRADING

A Finish Grading: The finishing of side slopes, cuts and fills shall be to smooth uniform surfaces that will merge with the adjacent terrain without noticeable break. Finishing shall be done according to grades shown on the drawings and without variations that are readily discernible.

B. Finish grading shall be done to the lines and grades shown on the drawings. All areas disturbed by the Contractor during construction operations shall be bladed smooth, shaped, and compacted as specified hereinbefore.

3.5 TOLERANCES

A. Top of Lawn Area Topsoil: Provide final grades within a tolerance of 1.5-inches when tested with a 10-foot straightedge.

3.6 PROTECTION

A. Protect turf areas and other features remaining as final work.

B. Protect existing trees, structures, fences, sidewalks, utilities, paving and curbs.

3.7 SCHEDULES

A. Compacted topsoil thickness at the following areas:
1 Turf areas: 6 inches.

3.8 CLEAN UP

A. After the topsoil has been spread and the final grades approved, the site shall be cleared of all grade stakes, surface trash and other objects that would hinder planting and/or maintenance of seeding. Paved areas over which hauling operations are conducted shall be kept clean, and any soil that may be brought upon the surfacing shall be promptly removed. The wheels of all vehicles shall be kept clean to avoid tracking soil on the surfacing of roads or other paved areas.

3.9 OBSERVATION AND ACCEPTANCE

A. The Architect will, upon minimum 48 hours notification, make a site visit to determine acceptability of work. Acceptance shall be given, by the Architect, upon satisfactory completion of the work indicated on the drawings and as specified in this section.

B. When the observed work does not comply with the aforementioned requirements, replace rejected work.

END OF SECTION 02923

SECTION 02936 - SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

Final preparation of topsoil, seeding regular fescue turf areas, seeding sports field turf areas, mulching, fertilizing, and herbicide applications.

A. Maintenance.

1.2 RELATED SECTIONS

A. Section 02923 - Topsoil Material and Application.

B. Section 20950 – Trees, Shrubs, and Groundcovers.

1.3 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Common Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 MAINTENANCE DATA

A. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit to the Owner before expiration of required maintenance periods. Include maintenance instructions for: cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer and herbicides.

1.5 QUALITY ASSURANCE

A. Provide seed in unopened containers certifying percentage of seed mix, the year of production, net weight, date of packaging, and location of packaging.

B. The seeded areas will be observed for acceptable grass coverage and will be acceptable when the grasses designated are growing, are in good condition, and no area more than 1/2 of 1 percent of the total area shall be bare, of which no single area shall be more than one (1) square foot in area. Any area larger than one (1) square foot shall be reseeded.

1.6 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. A certificate of compliance from governmental authorities indicating approval of seed mixture shall be submitted to the Owner's Representative.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01500.

B. Deliver grass seed to site in original unopened containers. Seed in wet, moldy or otherwise damaged packaging is not acceptable.

C. Deliver fertilizer in original, unopened waterproof containers showing weight, chemical analysis, and name of the manufacturer.

1.8 COORDINATION

A. Coordinate the work with all other construction activities on-site.

1.9 MAINTENANCE SERVICE

A. Furnish maintenance of seeded areas for 60 days after "Date of Final Acceptance" as determined by the Owner's Representative.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentages of weed seed, as specified.

B. Seed shall be labeled according to U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. All grass seed shall be free from noxious weed seeds, and recleaned; Grade "A" recent crop seed treated with appropriate fungicide at the time of mixing; and delivered to the site in sealed containers with dealer's guaranteed analysis. Seed that has become wet, moldy or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage by weight of pure live seed in each lot of seed shall be as follows:

Seeding Mixtures:

Regular Fescue Lawn Area Mix and Non-Irrigated Sports Field Turf Seed Mix

Proportion By Weight	Common Name	Botanical Name	Min. % Germ.	Min. % Pure Seed	Max. % Weed Sd.
90 %	Turf-Type Tall Fescue	Festuca arundinacae Select three (3) varieties of equal proportions from the following; *Apache III, constitution, Riverside, Cayenne, Pure Gold, Turbo, Blade Runner, Bingo, Ginesse II, Forte, Padre, Regiment II, Scorpion, Silverado II, Coshise III, Grande II, Raptor 2nd, Millennium, Finelawn Elite, Legitimate, and Tahoe.*	90 %	98 %	1.00
10 %	Improved Kentucky Bluegrass	Poa pratensis Select two (2) varieties of equal	85 %	98 %	1.00

proportions from
the following;
Moon Shadow, Impact, Langara, Sonoma, NU Destiny, Odyssey, Champlain, Freedom II, Misty, Award, Liberator, Awesome, Princeton 105, Champagne, Excursion, and Baronette.

Irrigated Sports Field Turf Seed Mix

Proportion By Weight	Common Name	Botanical Name	Min. % Germ.	Min. % Pure Seed	Max. % Weed Sd.
75 %	Improved Kentucy Bluegrass	Poa pratensis Select three (3) varieties of equal proportions from the following; *Midnight Blue, Boutique, Brooklawn; or approved equals from the Missouri University and/or Kansas State University current national turfgrass trials.*	85 %	98 %	1.00
25 %	Perennial Ryegrass	Lolium perenne Select two (2) varieties of equal proportions from the following; *Pizzazz or Manhattan 5; or approved equals from the Missouri University and/or Kansas State University current national turfgrass trials.*	85 %	98 %	1.00

2.2 ACCESSORIES

A. Mulching Material: Rye, oats or barley straw, free from weeds, foreign matter detrimental to plant life, clean and dry. Hay, chopped cornstalks or wheat straw is not acceptable.

B. Fertilizer: Fertilizer shall be of the grade, type and form specified below and shall comply with the rules of the Kansas Department of Agriculture and the following requirements:
   1. The grade of fertilizer will be identified according to the percent nitrogen (N), percent available phosphoric acid (P_2O_6) and percent water soluble potassium (K_2O) in that order and approval will be based on that identification.
   2. Fertilizer shall be of a type that can be uniformly distributed by mechanical application equipment.
   3. Fertilizer shall be furnished in a dry form.
   4. Fertilizer may be either homogenized or natural organic with at least 25 percent of the total nitrogen in a slow-release form.
   5. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis and name of the manufacturer. Store in a manner to prevent wetting and deterioration.

C. Pre-Emergence Herbicide: Tupersan (Siduron) as manufactured by Du Pont or approved equal. Pre-emergence Herbicide shall be compatible with recommended seed mixture.

D. Post-Emergence Herbicide: Subject to approval of the Owner's Representative.

E. Water: In the absence of adequate rainfall, the Contractor may use metered domestic water from building service lines or request from the local water authority the approval for water from the on-site or off-site fire hydrants for this work. The Contractor shall pay the local water authority for the cost of the water from the fire hydrants. The Contractor shall provide all needed hoses, sprinkler heads and other appurtenances. If the Contractor provides his own water, it shall not contain any material harmful to plant growth.

F. All other materials, not specifically described but required for a complete and proper installation or construction, shall be as selected by the Contractor subject to the approval of the Owner's Representative.

PART 3 EXECUTION

3.1 EXAMINATION OF SURFACE CONDITIONS

A. Inspections:
1. Before all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where seeding may commence.
2. Weeds that have emerged or persisted shall be removed by hand or eradicated with an acceptable post-emergent herbicide that is compatible with seeding and approved in writing by the Owner's Representative.
3. Verify that seeding may be completed according to the original design and the referenced standards.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with seeding in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION FOR SEEDING LAWNS

A. Apply specified fertilizers, after smooth raking of topsoil, at rates specified below and mix thoroughly into the upper 4 inches of topsoil. Delay applying fertilizer if lawn planting will not follow within three days.
1. *In leu of recommendations from a soil testing laboratory,* provide fertilizer containing sulfur and iron with slow release actual Nitrogen at the rate of 1.0 pounds (pounds actual N; not pounds of product) per 1,000 square ft. and actual Phosphorus and Potassium at the rate of 0.5 pounds (pounds actual P_20_6 and K_2O; not pounds of product) per 1,000 square ft. over the entire area to be seeded.

B. Apply fertilizer and seed in separate applications.

C. Fine grade turf areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. No grading shall be done when the soil is in a muddy or frozen condition. The final grading of side slopes, cuts and fills shall be to smooth, uniform surfaces that will merge with the adjacent terrain without noticeable break. Final grading shall be done according to lines and grades shown on the drawings to a maximum tolerance of one half inch for turf areas.

D. Restore turf areas to specified condition, if eroded or otherwise disturbed, after fine grading and before seeding operations.

E. Immediately before seeding, apply pre-emergence herbicide specified in strict accordance with the manufacturer's recommendation for application.

3.3 SEEDING

A. Sow seed mixture at a rate of 8 PLS pounds per 1,000 sq. ft. (348 lbs. PLS per acre).

B. Seed shall be drilled evenly over entire area in equal quantities in two (2) directions at right angles to each other. (4 PLS pounds per 1,000 sq. ft. each direction) HYDROSEEDING SHALL NOT BE USED FOR APPLYING SEED.

C. Do not seed areas more than that which can be mulched on same day.

D. Planting Season: Recommended dates for seed planting shall be March 1 - May 1 and September 1 - October 15. When delays in operations carry the work beyond the most favorable planting season for the grasses designated, or when conditions are such, because of drought, high winds, excessive moisture, or other factors, that satisfactory results are not likely to be obtained, the seeding operation shall be stopped and work shall be resumed only when conditions are again favorable, or when approved alternate or corrective measures and procedures have been put into effect and approved by Owner's Representative.

E. If observation indicates that areas have been skipped (during seeding operations or after there is a show of green) the sowing of additional seed on these areas will be required.

F. Do not sow immediately following rain, when ground is too dry, or during windy periods.

G. Roll seeded area with a roller not exceeding 112 lbs.

3.4 SEED PROTECTION AND WATERING

A. Protect seeded areas with slopes less than 3:1 against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket at the rate of 60 to 75 pounds per 1,000 square feet (1.3 to 1.6 tons per acre).

B. Protect seed areas with slopes of 3:1 or greater against erosion by installing erosion control blanket. The blanket shall be installed in strict accordance with the manufacturers' recommendations for installation.

C. Anchor mulch in place with a mechanical slicer. All slopes shall be sliced parallel to the slope. Take precautions to prevent damage of construction or other plantings next to mulched areas.

D. Watering: The Contractor shall be responsible for having adequate water available at the site before and during the seeding operations. The seed shall be watered with a fine spray immediately after each area has been mulched. After seeding and mulching is completed in any

one section, the entire area shall be thoroughly watered to a depth of 4 inches below finish grades. Subsequent watering should continue to maintain moisture at levels necessary to establish an acceptable lawn.

3.5 MAINTENANCE

A. Begin maintenance immediately after sowing seed.

B. Maintain seeded lawns until all the following minimum requirements have been met:
   1. For not less than 60 days after "Date of Acceptance" as determined by the Owner's Representative for the work in this section.
   2. Until the grass has been mowed as specified.
   3. Longer than 60 days, as required, to establish acceptable lawn as defined in Part 1, 1.5, paragraph B. Partial acceptance of seeded lawn is not allowable. If seeded in fall and not given full 60 days of maintenance, or if not considered acceptable then, continue maintenance the following spring until acceptable lawn is established.

C. When the grass reaches a mowing height of 3-inches, the Contractor shall notify the Owner's Representative that the seeded grass is ready to be mowed, and upon approval, the Contractor shall cut the grass to a height of 2-inches, removing no more than a third of the leaf height. Do not bag the clippings unless the grass reaches a height of 3-1/2" before it is mowed.

D. Throughout the Maintenance Period, the Contractor shall be responsible for watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

E. In the absence of rainfall, watering shall be done to maintain moisture levels necessary to establish an acceptable lawn. Soil shall be kept moist always. If necessary, watering shall be done during the heat of the day to help prevent wilting. The Contractor shall water the grass areas as necessary to maintain adequate moisture levels until final acceptance, which includes mowing the grass and doing any necessary replanting.

F. During the maintenance period, the application of post-emergence herbicide shall be applied only upon the emergence of broadleaf weeds. At such time, the Contractor shall notify the Owner's Representative in writing for approval to use the herbicides, indicating the date for application, type of chemical and rate of application. Only herbicides labeled for use on newly established turf shall be used. All herbicides shall be used in strict accordance with manufacturers' recommendation for application. The Contractor shall be responsible for remedying any damages resulting from improper selection and/or use of herbicides. Immediately reseed areas that show bare spots.

3.6 CLEANUP AND PROTECTION

A. During seeding operations, keep all areas clean and in an orderly condition. Properly dispose of all resultant dirt, debris and other waste materials.

B. Protect all work and materials from damage due to seeding operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace landscape work as directed at no additional cost, unless the damage is the result of vandalism.

C. Upon completion, the contractor shall remove all containers, surplus materials an debris and leave the site in a clean and orderly condition acceptable to the Owner's Representative.

3.7 OBSERVATION AND ACCEPTANCE

A. When seeding work is completed, including maintenance, the Owner's Representative will, upon minimum 48 hour notification, make a site visit to decide final acceptability of seeding.

B. When observed seeding work does not comply with requirements, replace rejected work and continue specified maintenance until re-observed by the Owner's Representative and found acceptable. If the work continues to be unacceptable upon re-observation and additional site visits are required, the Contractor shall pay the Owner's Representative for his time and reasonable expenses for travel to and from the Site and other necessary expenses until the work is found acceptable.

END OF SECTION 02936

SECTION 02950 - TREES, SHRUBS AND GROUND COVERS

PART I GENERAL

1.1 SECTION INCLUDES

A. Pre-Installation Meeting.

B. Preparation of subsoil and topsoil.

C. New trees, shrubs and ground covers.

D. Mulch.

E. Maintenance.

1.2 RELATED SECTIONS

A. Section 02923 - Topsoil material and application.

B. Section 02936 – Seeding.

1.3 REFERENCE STANDARDS

A. ANSI Z60.1 - AAN-ASNS: American Association of Nurserymen, Inc., "American Standard for Nursery Stock" - Current Edition.

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

B. Plants: Living trees, shrubs and ground covers specified in this Section and described in ANSI Z60.1 for number one grade nursery stock as adopted by the American Association of Nurserymen.

1.5 MAINTENANCE DATA

A. Operation Data: Submit for continuing Owner maintenance following final acceptance of project.

B. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Pre-Installation Meeting: Prior to starting any work of this section, the Landscape Contractor shall contact the Owner's Representative to schedule a pre-installation meeting to discuss installation expectations. The Landscape Contractor, General Contractor, Project Architect,

North Kansas City Schools, and Project Landscape Architect shall be represented at this meeting.

B. Plant Material Review: The Landscape Contractor shall assemble plant materials, for review by the Landscape Architect, at the nursery or project site. The Landscape Architect will review the plant materials for compliance with specification and drawing requirements for name, variety, size and quality. The Landscape Contractor shall be solely responsible for supplying quality plant material. Do not install plants that have not been reviewed and/or tagged by the Landscape Architect.

C. Disease and Insect Control Standards: All plant material shall meet or exceed the requirements of Federal, State and County laws requiring inspection for plant disease and insect control.

D. Approval and Rejection of Materials: The Owner's Representative shall reserve the right to select and/or reject any materials or workmanship, which in his opinion, does not meet the requirements of the Drawings and Specifications. All rejected material shall be removed from the site, by the Contractor, as directed.

E. Substitution of Materials: The Contractor shall locate all necessary materials to perform the job before bid submittal. He shall also confirm their availability, obtainability, and quality. Substitutions of materials will be allowed with direct authorization by the Owner's Representative. Substitution will be made by written request by the Contractor, describing available size, variety, price adjustments, etc., to the Owner's Representative, before installation of said material.

F. After the installation is complete, the Landscape Contractor shall present to the Owner's Representative a written certification that all plant materials and completed installation is in compliance with the Specifications and Drawings.

1.7 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating the plants with three years experience. Native plant nursery shall also have three years experience.

B. Installer Qualifications: Install work using skilled persons, proficient in the trades required, in a neat, orderly and a responsible manner with recognized standards of workmanship. The installer shall have not less than five (5) years successful experience with installation of similar work. If requested by Owner's Representative, submit list of three (3) projects completed in the last two (2) years of similar complexity to this project with name and location of project, Owner's name and telephone number, the name of project, Architects or Engineer's name and telephone number.

C. Maintenance Services: Performed by installer.

1.8 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for herbicide composition.

B. Provide a certificate of compliance from authority having jurisdiction indicating approval of plants and herbicide mixture.

C. Plant Materials: Certified by federal and state departments of agriculture. Described by ASTM Z60.1; free of disease or hazardous insects.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.

B. Protect plants until planted.

C. Deliver plant materials immediately before placement. Keep plants moist and protected from excessive exposure to the sun and damage from construction operations.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 90 degrees F.

B. Do not install plants when wind velocity exceeds 30 mph.

1.11 WARRANTY

A. Warranty plant material to remain alive and be in healthy, vigorous condition for a period of 1 year after completion and acceptance of entire project. Native trees and shrubs shall be warranted for a period of 2 years after completion and acceptance of entire project.

1. Inspection of plants will be made by the Owner's Representative at completion of planting.

B. Replace, in accordance with the drawings and specifications, all plants that are dead or, as determined by the Owner's Representative, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence. The cost of such replacements is at the Contractor's expense. Replacement plants shall be of the same size and species as specified.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lighting storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the owner.

D. Remove and immediately replace all plants, as determined by the Owner's Representative, to be unsatisfactory during the initial planting installation.

1.12 MAINTENANCE SERVICE

A. Maintain plant materials immediately after placement. Continue maintenance until acceptance of work by Owner's Representative.

B. Maintenance to include:

1. Cultivation and weeding plant beds and tree pits.
2. Applying herbicides for weed control according to manufacturers' instructions. Remedy damage resulting from improper use of herbicides.
3. Remedy damage from improper use of insecticides.
4. Remedy damage from improper planting methods and fertilizer.
5. Watering to maintain moisture levels necessary to establish acceptable trees, shrubs and ground covers.

6. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
7. Disease control.
8. Maintaining wrapping, guys, and stakes. Repair or replace accessories when required.

PART 2 PRODUCTS

2.1 TREES, SHRUBS, AND GROUND COVER

A. Trees, shrubs and ground covers: Species and size identified in the plant schedule, grown in climatic conditions similar to those in the locality of the Work. The native plants shall be collected on flood plain sited in Kansas or Missouri.

2.2 SOIL MATERIALS

A. Topsoil: Excavated from the site or imported. Refer to Section 02923 - Topsoil Material and Application.

2.3 ACCESSORIES

A. Water: In the absence of adequate rainfall, The Contractor may request from the local authority the approval for water from the on-site or off-site fire hydrants for this work. The Contractor shall pay for the cost of the water. The Contractor shall provide all needed hose, sprinkler heads and other appurtenances. If the Contractor provides his own water, it shall not contain any material injurious to plant growth.

B. Pre-Emergence Herbicide (for plant pit surface): Treflan (Trifluralin) or Surflan (Oryzalin) as manufactured by DowElanco or approved equal. Pre-emergence herbicide shall be compatible with installed plant material.

C. Post-emergence herbicide: Subject to approval of the Owner's Representative.

D. Pesticide: Subject to approval of the Owner's Representative.

E. Mulching Material: Shredded Hardwood free of growth or germination inhibiting ingredients.

F Manicured Edge: Edging shall be a manicured edge. Cut edge into the soil with a v-shaped channel, or approved equal. Channel shall be 6" x 4" deep and then filled with hardwood mulch.

G. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss of moisture from plants. Deliver in manufacturers' fully identified containers and mix according to manufacturers' instructions.

H. Tree Stakes: Metal tee (fence) posts. Metal tee stakes shall be painted green, approximately 2" wide and 6 - 6.5 feet long. Stakes are to be driven a minimum of 2 feet into undisturbed stable earth. Provide a minimum of two stakes for each ornamental tree and three stakes for each shade tree planted.

I. Wire Guys: 12-gauge, zinc coated wire, or approved equal. Wires are to be looped twice and twist tightened for sufficient tension to support a tree.

J. Plant Protectors: ½" I.D. rubber (garden) hose collar or approved equal over cable and around tree trunks to protect plant stems, trunks, and branches.

K. Weed Barrier Mats: Proposed weed control mat shall be 4-foot by 4-foot in size, photodegradable polypropylene, thickness of 16 mils, water permeability of 10 gallons per minute, and weight of 3 ounces per square yard, held in place with nine (9) 1 gage flat top staples 6 inches in length.

L. Trunk Protectors: Trunk protectors shall be reclaimed rigid PVC with a white materbatch low-density polyethylene. The tree guard shall be approximately 6 millimeters thick, weight 2.3 grams per inch, have a diameter of 1-inch and a length of 24-inches.

M. All other materials, not specifically described but required for a complete and proper installation or construction, shall be as selected by the Contractor subject to the approval of the Owner's Representative.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where planting may commence.

B. Weeds that have emerged or persisted shall be removed or eradicated.

C. Verify that prepared topsoil is ready to receive work.

D. Verify that required underground utilities are available, in proper location, and ready for use.

E. Verify that planting may be completed according to the original design and the referenced standards.

F. Discrepancies:
1. In case of discrepancy, immediately notify the Owner's Representative.
2. Do not continue with planting in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 EXCAVATION FOR TREES, SHRUBS AND GROUND COVERS

A. Dig plant pits twice as wide as the plant root system.

3.3 PLANTING

A. The Contractor shall stake all tree, shrub, and plant bed locations for review by the Owner's Representative, prior to planting.

B. Set balled and burlapped (B&B) stock on undisturbed soil, plumb and in center of pit or trench with top of balls at same elevation as adjacent finished landscape grades or slightly higher. Place plants for best appearance. Planting holes for native trees and shrubs may be augered with a 10" or 12" bit or dug by hand.

C. Remove ropes, and wires, from the root ball. Remove burlap from sides of balls; retain on bottoms.

D. When set, place additional backfill around base and sides of balls, and work each layer to settle backfill and eliminate voids and air pockets.

E. When excavation is approximately 2/3 full, water thoroughly before placing the remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

F. Set container grown stock, as specified for balled and burlapped stock, except cut cans on two sides with an approved can cutter; Remove non-biodegradable root containers.

F. Do not fertilize trees and shrubs unless planting occurs in the late fall when the shrubs are completely dormant. Fertilize the 1st year in late fall or winter with Scotts Pro-Grow 33-3-6 Field Fertilizer/ER (slow release) at rate of 30g. (2 tablespoons/shrub) to a distance of 3 feet across the drip zone.

3.4 INSTALLATION OF ACCESSORIES

A. Around the perimeter of each tree pit, build a watering saucer 4 inches above the crown of the plant and shape and slope the surface away from the top of the saucer, approximately 18 inches wide down to existing grades.

B. "Pin" the biodegradable weed barrier mat to the ground around each native tree and shrub.

C. Cut manicured edge and mulch shrub and ground cover beds. Apply the specified bark mulch to a depth of three (3) inches, evenly spread over the entire area of each plant bed area and finish level with adjacent finish grades.

D. Apply anti-desiccant, using power spray, to provide an adequate film over trunks, branches, stems, twigs and foliage.
   1 If deciduous trees or shrubs are moved when in full leaf, spray with anti-desiccant at the nursery before moving and spray again two weeks after planting.

E. Treat the entire plant pit surface with pre-emergence herbicide in strict accordance with manufacturers' recommendations for application.

F. Pruning: Prune according to standard horticultural practices. Pruning of branches shall be done only to remove dead wood, suckers, damaged limbs and broken or badly bruised branches. Use only clean, sharp tools. Do not cut or prune 1/3 of the plant top growth before or after planting.
   1. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

G. Install trunk protection guards on all trees and shrubs as specified.

3.5 PLANT SUPPORT

A. Stake all trees as detailed, using one plant protector wrapped guy wire per stake and driving all stakes into the ground at least two (2) feet. All stakes and guy wires shall be removed from the project, by the Contractor, at the end of one (1) calendar year and before warranty inspection.

3.6 FIELD QUALITY CONTROL

A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged before or during planting.

3.7 MAINTENANCE

A. Neatly trim plants when necessary.

B. Immediately remove clippings after trimming.

C. In the absence of adequate rainfall, watering shall be performed to maintain moisture levels necessary to establish healthy and vigorous plant material. The Contractor shall water the plant material as necessary to maintain adequate moisture levels until final acceptance.

D. Control growth of weeds. Apply herbicides according to manufacturers' instructions. Remedy damage resulting from improper use of herbicides.

E. Until final acceptance, the application of post-emergence herbicide shall be applied only upon the emergence of broadleaf weeds. At such time that weeds emerge, the Contractor shall notify the Owner's Representative in writing for approval to use the herbicides, indicating the date for application, type of chemical and rate of application. Only herbicides labeled for use on plant material installed shall be used. All herbicides shall be used in strict accordance with the manufacturer's recommendation for application. The Contractor shall be responsible for remedying any damages resulting from improper use of pesticides.

3.8 CLEANUP AND PROTECTION

A. During the planting operations, keep all areas clean and in an orderly condition. Properly dispose of all resultant dirt, debris and other waste materials.

B. Protect all work and materials from damage due to planting operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and until final acceptance. Treat, repair, or replace landscape work as directed at no additional cost, unless the damage is the result of vandalism.

3.9 OBSERVATION AND ACCEPTANCE

A. When planting work is completed, the Owner's Representative will, upon minimum 48 hour notification, make a site visit to determine acceptability of planting.

B. When observed planting work does not comply with requirements, replace rejected work and continue specified maintenance until re-observed by the Owner's Representative and found acceptable.

END OF SECTION 02950

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Concrete toppings.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Qualification Data: For Installer.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

E. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

F. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

G. Field quality-control test reports.

H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or Type II, gray. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or F, not to exceed 20% of cement content by weight. Do not use when ambient air temperatures are expected below 35 degrees F during the first 48 hours after placement.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S and 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/8-inch (10-mm) nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products:

a. Fortifiber Corporation; Moistop Ultra A.
b. Raven Industries Inc.; Vapor Block 15.
c. Reef Industries, Inc.; Griffolyn Type-65G.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.8 CURING MATERIALS

A. Provide moisture retaining covered curing of interior slabs for 3 days minimum using cover materials that limit moisture loss to not more than 0.055 g/cubic cm in 72 hours when tested per ASTM C-156. Use cover materials that will not stain or impact any texture to the concrete surface.

B. Water: Potable.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 540 lb/cu. yd. (309 kg/cu. m).
3. Slump Limit: 1-3 inches (25-75 mm).
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
3. Slump Limit: 1-3 inches (25-75 mm).
4. Air Content: Do not allow air content of troweled finished toppings to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Match existing chamfer on exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of

weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

   1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.

   1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

   1. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

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 (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3.12 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(s). 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.

3.13 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. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place

patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 03300

SECTION 04720 - CAST STONE

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. Cast stone trim including the following:

a. Coping.

b. Standard units

B. Related Sections include the following:

1. Division 3 Section "Plant-Precast Architectural Concrete."
2. Division 4 Section "Unit Masonry Assemblies" for installing cast stone units in unit masonry.

1.3 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

E. Full-Size Samples: For each type of cast stone unit required.

1. Make available for Architect's review at Project site.
2. Make Samples from materials to be used for units used on Project.
3. Approved Samples may be installed in the Work.

F. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

G. Quality-Control Plan: Manufacturer's written quality-control plan that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."

1. Provide copies of documentation showing compliance with quality-control plan as requested by Architect.

H. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.

1. Manufacturer is a producing member of the Cast Stone Institute or has on file and follows a written quality-control plan approved by Architect that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store installation materials on elevated platforms, under cover, and in a dry location.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Do not use admixtures unless specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.3 CAST STONE UNITS

A. Basis of Design:

1. Northfield Block Company: Prairie Stone 16424CS.

2. Northfield Block Company: Prairie Stone 4424

B. Provide cast stone units complying with ASTM C 1364 using the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364, or are made from cast stone that has a history of successful resistance to freezing and thawing.

C. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

E. Cure units by one of the following methods:

1. Cure units with steam in enclosed curing room at temperature of 105 deg F (41 deg C) or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
3. Cure units to comply with one of the following:

a. Not less than 5 days at mean daily temperature of 70 deg F (21 deg C) or above.
b. Not less than 6 days at mean daily temperature of 60 deg F (16 deg C) or above.
c. Not less than 7 days at mean daily temperature of 50 deg F (10 deg C) or above.
d. Not less than 8 days at mean daily temperature of 45 deg F (7 deg C) or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures: As selected by Architect from manufacturer's full range.

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Division 4 Section "Unit Masonry Assemblies."

2.5 ACCESSORIES

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Available Manufacturers:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.6 MORTAR MIXES

A. Comply with requirements in Division 4 Section "Unit Masonry Assemblies" for mortar mixes.

2.7 SOURCE QUALITY CONTROL

A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.

    1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

    1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

    1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.

B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

C. Set units in full bed of mortar with full head joints, unless otherwise indicated.

    1. If not indicated, set units with joints 3/8 to 1/2 inch (10 to 13 mm) wide.
    2. Build anchors and ties into mortar joints as units are set.
    3. Fill dowel holes and anchor slots with mortar.
    4. Fill collar joints solid as units are set.
    5. Build concealed flashing into mortar joints as units are set.
    6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
    7. Keep joints at shelf angles open to receive sealant.

D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

G. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.

1. Form open joint of width indicated, but not less than 3/8 inch (10 mm).

H. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant, unless otherwise indicated.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.

2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04720

SECTION 04810 - UNIT MASONRY ASSEMBLIES

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 unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Face brick.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 7 Section "Sheet Metal Flashing and Trim" for sheet metal flashing.
2. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
4. Weep holes/vents.
5. Accessories embedded in masonry.

E. Qualification Data: For testing agency.

F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

   a. Include material test reports substantiating compliance with requirements.
   b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
   d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
5. Prism Test: For each type of construction required, per ASTM C 1314.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost

or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).

2. Weight Classification: Normal weight, unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 CONCRETE LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade MW or SW, Type FBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 5500 psi (37.9 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings 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 (3 m) or shall have a history of successful use in Project's area.
5. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
6. Available Products:

   a. Owensboro Brick and Tile – Owensboro, Kentucky

      1) Modified: “Flashed Martingale”

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

C. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

D. Aggregate for Grout: ASTM C 404.

E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Addiment Incorporated; Mortar Kick.
b. Euclid Chemical Company (The); Accelguard 80.
c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
d. Sonneborn, Div. of ChemRex; Trimix-NCA.

F. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill-galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
4. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
5. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
6. Stainless-Steel Sheet: ASTM A 666, Type 316.
7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
8. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
2. Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls, unless otherwise indicated.

D. Adjustable Masonry-Veneer Anchors

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

a. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie.
b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
c. Available Products:

1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
3) Hohmann & Barnard, Inc.; DW-10 or DW-10-X.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

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. Weep/Vent Products: Use the following, unless otherwise indicated:

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

a. Basis of Design:

1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.
3. Limit cementitious materials in mortar for exterior masonry to portland cement and lime.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.

2. For reinforced masonry, use Type N.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

2.13 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.

C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c., unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems."

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
3. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
5. Trim wicking material flush with outside face of wall after mortar has set.

3.9 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.

2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

H. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

3.10 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 04840 – THIN BRICK/PANEL BRICK VENEER

1. GENERAL

    1. SUMMARY

        A. Related Document: General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

        B. Section Includes:

            1. Adhesive adhered, solid, manufacturing thin brick/panel brick veneer for exterior panelized system and individualized unit application on rigid backer board over building substrate
            2. Adhesives, fasteners and mortar.
            3. Moisture barrier

        C. Related Documents

            1. Section 05400 "Cold Formed Metal Framing" for exterior wall framing.
            2. Section 06100" Rough Carpentry" for exterior sheathing.
            3. Section 07920 "Sealants" for sealants at control joints and intersections with dissimilar materials

    2. SUBMITTALS

        A. Submit following:

            1. Product Data: Submit for all specified products. Include all applicable physical and performance data.
            2. Samples: Submit 4 samples of thin brick/panel brick veneer units to illustrate color, texture, and size range of each type unit.
            3. Manufacturer's detailed installation instructions.
            4. Certification listed in Quality Assurance article of Part 1 this Section

    3. FIELD SAMPLES

        A. Sample Installation: Construct thin brick to 3 feet by 4 feet panel size, including sub-framing, substrate surfaces, fasteners, adhesive bonding, joint work, moisture barrier, grout color, expansion joints and control joints.
            1. Obtain Architect's approval before beginning work. Protect and retain sample as a basis on which the quality of the work will be judged. Do not remove until Substantial Completion.
            2. Accepted Field Sample: May not remain as part of completed Work.

    4. QUALITY ASSURANCE

A. Installer: Experienced in similar types of work of similar scope and be able to furnish list of previous jobs and references if requested by Architect.

B. Expansion Joints: Provide expansion joints as indicated on Drawings or, if not indicated, install at frequency and in accordance with details and as recommended by manufacturer. Confirm location and frequency with Architect before beginning work.

C. Certifications:

1. Provide written documentation that products have met or exceeded at least one of the following certifications for a minimum of 10 years:
   a. FHA-HUD.

5. PROJECT CONDITIONS

A. Environmental Requirements:

1. Minimum air temperature of 40 degrees F (4 degrees C) to, during, and for 48 hours after completion of work; and
2. Cold Weather Requirements: IMAC (International Masonry Industry All-Weather Council) – Recommended Practices and Guide Specifications for Cold- Weather Masonry Construction.

6. DELIVERY, STORAGE, AND HANDLING

A. General:

1. Store mortar materials on pallets in dry place.
2. Protect materials from rain, moisture, and freezing temperatures.
3. Store manufactured thin brick/panel brick veneer above ground on level platforms, which allow air circulation under stacked units.
4. Handle units on pallets or flat bed barrows.

7. WARRANTY

A. Special Warranty: Prepare and submit.

1. Provide a 20- year warranty against manufacturing defects in manufactured thin brick/panel brick veneer products.

2. PRODUCTS

1. ACCEPTABLE THIN BRICK/PANEL BRICK

A. Subject to compliance with requirements, provide the following product:

1. BRICKETTES ® as manufactured by Panel Brick Manufacturing Inc. 1120 Ewing Road, Owensboro, Kentucky 42302, (270) 684-7268.
   a. Thin Brick/Panel Veneer Style/Color:

2. BRICKETTES ® THIN BRICK VENEER

A. Thin Brick Veneer:

1. Kiln fired thin brick, composed of following materials:
    a. Clay, shale, fire clay, sand or mixture thereof, kiln fired to fusion to produce clay masonry units per ASTM C1088, Type TBX (Select)
2. Durability: ASTM C1088, Grade Exterior.
3. Freeze and Thawing: No breakage and not greater than 0.5% loss in dry weight when tested in accordance with ASTM C1088.
4. Thin brick veneer size: 7 inches by 2 inches by ½ inch.

B. Thin brick special shapes: Corner units.

3. THIN BRICK VENEER ACCESSORIES

A. Rigid Backer Board: high density, asphalt impregnated, fiberboard nail base, ASTM C 208 Rigid backer board shall meet requirements specified in Federal Specification LLL-535B, Class E, Style 2 and ANSI/ AHA A194, 1-1985, Type IV, Class 2.

1. Manufacturer: Temple Inland Corporation.

B. Adhesive: Exterior, waterproof, synthetic rubber base adhesive, complying with APA AFG-01. For exterior application of individual thin brick veneer units, interior/exterior water base, non-flammable adhesive.

1. Manufacturer: Panel Brick Manufacturing Inc. P.O. Box 907, 1120 Ewing Road, Owensboro, Kentucky 42302, (270) 684-7268.

C. Mortar: A rich mixture of the following materials, mixed in accordance with the manufacturers detailed installation instructions for tuck pointing thin brick veneer joints.

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold- weather construction. Provide natural color or white cement as required to produce mortar color indicated.
2. Hydrated Lime: ASTM C207, Type S.
3. Aggregate for Mortar: ASTM C144.
    a. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
    b. White-Mortar Aggregates: Natural white sand or crushed white stone.
    c. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
4. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
5. Water: Potable.

6. Thoroughly mix grout ingredients in quantities needed for immediate use. Mix grout to ASTM C270, Type S proportions.

D. Mortar Mixes:

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
2. Limit cementitious materials in mortar to portland cement and lime.
3. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
    a. Pigments shall not exceed 10 percent of Portland cement by weight.
    b. Mix to match Architect's sample.

E. Moisture Barrier:

1. [Tyvek Stucco Wrap, by E.I. Dupont, or comparable product as approved by Architect. Provide tape to seal joints, seams, and tears, of same permeance as membrane.]

F. Joint Sealant: Refer to Section 07920.
G. Fasteners: Coated 1-1/2 inch nails, staples, or screws of type and for spacing as recommended by thin brick veneer manufacturer for loads encountered.
H. Cleaner: Nonacid cleaner as recommended by thin brick veneer manufacturer.

3. EXECUTION

1. EXAMINAATION AND PREPARATION

A. Examination:

1. Verify that field conditions are acceptable and are ready to receive work in accordance with the manufacturers written installation instructions.
2. Verify that built-in items are in proper location and ready for roughing into masonry work.
3. Consult Architect if deficiencies exist. Correct deficiencies in accordance with requirements of thin brick veneer manufacturer's written installation instructions.

B. Protect surrounding area from possible damage during installation work.
C. Initialing installation constitutions Installer's acceptance of substrates.

2. INSTALLATION

A. Moisture Barrier:

1. Apply sheets horizontally, starting at the base of the wall, and lapping each successive upper sheet over the previous lower sheet.

2. Lap horizontal and vertical joints 6 inches.
3. Cut and seal joints, penetrations, openings, and projections with manufacturer's recommended tape.
4. Install with corrosion-resistant staples.

B. Individual Brickette ® Thin Brick Veneer Unit Application

1. Exterior: Cover the wall substrate with Interior/Exterior adhesive to a depth in accordance with manufacturers written installation instructions.
2. Place individual Brickette ® units in position level, with 3/8 inch joint spacing, plumb with surrounding units. Apply firm pressure to bed the unit solidly in the adhesive base.
    a. Bond Pattern: Running bond, or as indicated on the Drawings.
    b. Install outside corner return units with short and long lengths alternated.
    c. Plan work to minimize jobsite cutting. Perform necessary cutting with proper tools to provide uniform edges; take care to prevent breaking unit corners or edges.

C. Panelized Thin Brick Veneer (Panel Brick) System Application:

1. Mechanically fasten rigid backer board with thin brick veneer facing to substrate and supporting structure with [screw] [nail] fasteners per square foot minimum, in accordance with the manufacturer's written installation instructions.
    a. Fastener Schedule: Provided by the thin brick veneer manufacturer.
2. Interlock rigid backer board panels in a [one-half] [one-third] running bond.]

D. Jointing:

1. Allow adhesive to set and cure in accordance with the manufacturer's instructions for individual thin brick veneer units.
2. Install mortar to thin brick veneer joints using a tuck pointing tool, metal tipped mortar bag or a grout setting machine in accordance with the manufacturer's written installation instructions.
    a. Fill joints completely with mortar.
    b. Remove excess mortar; do not allow mortar to dry on face of units.
    c. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
    d. Clean and finish joints in accordance with manufacturer's instructions.

E. Control Joints: Size in accordance with Section 07920 for sealant performance, but in no case larger than adjacent mortar joints in exposed thin brick veneer units.

F. Expansion Joints: Provide where indicated on Drawings or as recommended by system manufacturer.

G. Built-in Work: As work progresses, build door and window frames, nailing strips, anchor bolts, plates, and other items specified in various sections.

1. Build in items plumb and level.
2. Do not build in organic materials subject to deterioration.

3. ADJUSTING

   A. Cutting and Fitting: Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other sections of work to provide correct size, shape, and location.

4. CLEANING AND SEALING

   A. Cleaning:
      1. Remove excess mortar and smears using brush or steel wool.
      2. Replace defective mortar. Match adjacent work.
      3. Clean soiled surfaces with non-acidic solution, acceptable to the thin brick veneer manufacturer, which will not harm masonry or adjacent materials.
      4. Leave surfaces thoroughly clean and free of mortar and other soiling.
      5. Use nonmetallic tools in cleaning operations.

END OF SECTION

SECTION 05120 - STRUCTURAL STEEL

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. Structural steel.
2. Grout.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Steel Deck" for field installation of shear connectors.
3. Division 5 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 9 painting Sections and Division 9 Section "High-Performance Coatings" for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Structural Additions.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections 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: For Installer.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 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 erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. 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.

1.8 COORDINATION

A. Furnish 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 A 992/A 992M.

B. Channels, Angles-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type.

a. Finish: Plain.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36..

1. Configuration: Straight.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
5. Finish: Plain.

E. Threaded Rods: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6).

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
3. Finish: Plain.

F. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

G. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, 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's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. 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.

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-SP 3, "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.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

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. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. 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-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. 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 A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, 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.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
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 base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing 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 forming 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. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. 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.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05120

SECTION 05310 - STEEL DECK

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. Noncomposite form deck.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
3. 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.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. 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."

E. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

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:

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. Nucor Corp.; Vulcraft Division.
g. Roof Deck, Inc.
h. United Steel Deck, Inc.
i. Valley Joist; Division of EBSCO Industries, Inc.
j. Verco Manufacturing Co.
k. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 NONCOMPOSITE FORM DECK

A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 80 (550) minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: Manufacturer's standard.

2. Profile Depth: 1-1/2 inches (38 mm).
3. Design Uncoated-Steel Thickness: 0.0358 inch (0.91 mm).
4. Span Condition: As indicated.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. 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.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

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. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. 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.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and 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.

3.5 REPAIRS AND PROTECTION

A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

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 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Ceiling joist framing.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

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 Loads: As follows:

a. Dead Loads: Weights of materials and construction.
b. Live Loads: Office Buildings
   1) Corridors above first floor: 80 psf uniform/2,000 lbs concentrated.
   2) Lobbies and first floor corridors: 100 psf uniform/2,000 lbs concentrated.
   3) Offices: 50 psf uniform/2,000 lbs concentrated.
   4) Stairs and landings: 100 psf uniform
c. Roof Loads: Business/Manufacturing/Storage
   1) Ordinary flat, pitched or curved roofs: 20 psf uniform
   2) Over manufacturing/storage/warehouse: 2,000 lbs concentrated
d. Snow Loads: 20 psf uniform
e. Wind Loads: 12 psf uniform
f. Seismic Loads: Use Equivalent Lateral Force Analysis Procedure.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
   b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
   d. Floor Joist Framing: Vertical deflection of 1/480 for live loads and l/360 for total loads of the span.
   e. Roof Trusses: Vertical deflection of 1/240 of the span.
   f. Roof Rafter Framing: Horizontal deflection of 1/240 of the horizontally projected span.
   g. Ceiling Joist Framing: Vertical deflection of 1/240 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1/2 inch (13 mm).

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, spacings, 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.

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 evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

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. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. 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.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. 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: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).

2.3 LOAD-BEARING WALL FRAMING

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

1. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
2. Flange Width: 2-1/2 inches (63 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
2. Flange Width: 2-1/2 inches (63 mm).

D. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

1. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
2. Top Flange Width: 2-1/2 inches (63 mm).

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

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

1. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
2. Flange Width: 2-1/2 inches (63 mm).

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: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).

b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch (25 mm).

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0966 inch (2.45 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.6 FRAMING ACCESSORIES

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

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.7 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. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. 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 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 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 instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed 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, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: 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.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

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.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. 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.

D. 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. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. 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, and complying with requirements for spacing, edge distances, and screw penetration.

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

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

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

H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

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

J. 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 (1:960) 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 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

   1. Anchor Spacing: 32 inches (813 mm).

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

   1. Stud Spacing: 16 inches (406 mm).

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

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

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

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

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced 48 inches (1220 mm). Fasten at each stud intersection.

   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.

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

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

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm).

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb 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.

1. Install double deep-leg deflection tracks and anchor outer track to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) 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 wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed 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 that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

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. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Elevator machine beams and/or hoist beams.
5. Support angles for elevator door sills.
6. Steel weld plates and angles for casting into concrete not specified in other Sections.
7. Miscellaneous steel trim including steel edgings and loading-dock edge angles.
8. Metal bollards.

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 or built into unit masonry.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 5 Section "Structural Steel."
4. Division 5 Section "Metal Stairs."
5. Division 5 Section "Pipe and Tube Railings."
6. Division 14 Section "Electric Traction Elevators" for elevator pit ladders and support angles for elevator door sills.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. 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.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.
3. Metal nosings and treads.
4. Prefabricated building columns.

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. Mill Certificates: Signed by manufacturers certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

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."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction 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 or masonry. Deliver such items to Project site in time for installation.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the 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. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) or as indicated.
2. Material: Galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.064-inch (1.6-mm) nominal thickness.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 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 (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); 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 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. 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 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

I. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

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.

1. 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 six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a 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 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 Section “High Performance Coatings.”

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain

structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work 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.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent

construction 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.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 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 two integrally welded steel strap anchors for embedding in concrete.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

D. Prime exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.11 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails 18 inches (457 mm) apart, unless otherwise indicated.
4. Support each ladder with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
2. Rungs: 1-inch- (25-mm-) diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
6. Available Products:

   a. IKG Industries, a Harsco company; Mebac.
   b. W. S. Molnar Company; SlipNOT.

7. Galvanize exterior ladders and interior ladders, where indicated, including brackets and fasteners.

2.12 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick steel baseplates for bolting to concrete slab, unless otherwise indicated. Drill baseplates at all 4 corners for 3/4-inch (19-mm) anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.13 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.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces 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-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. 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.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. Dull Satin Finish: No. 6.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 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 I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with expansion anchors or concrete footings. Provide four 3/4-inch (19-mm) bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

C. Where Indicated on Drawings, anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05511 - METAL STAIRS

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. Preassembled steel stairs with concrete-filled and abrasive-coating-finished formed-metal treads.
2. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 5 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
3. Division 5 Section "Pipe and Tube Railings" for pipe and tube railings.
4. Division 6 Section “Miscellaneous Carpentry" for wood blocking for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

B. Structural Performance of Railings: 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. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) 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. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
   b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
   c. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Precast concrete treads.
3. Epoxy-resin-filled stair treads.
4. Nonslip aggregates and nonslip-aggregate finishes.
5. Abrasive nosings.
6. Metal floor plate treads.
7. Paint products.
8. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. 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 Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Precast concrete treads.
2. Epoxy-resin-filled stair treads.
3. Stair treads with nonslip-aggregate surface finish.
4. Metal floor plate treads.
5. Grating treads.
6. Abrasive nosings.

E. Welding certificates.

F. Qualification Data: For professional engineer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.

1. Test railings according ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal stairs. 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.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components 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).

C. Iron Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.4 ABRASIVE NOSINGS

A. Cast-Metal Units: Cast gray iron, Class 20, 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:

a. American Safety Tread Co., Inc.
b. Balco Inc.
c. Barry Pattern & Foundry Co., Inc.
d. Granite State Casting Co.
e. Safe-T-Metal Co.
f. Wooster Products Inc.

2. Configuration: Cross-hatched units, 3 inches (75 mm) wide with lip to be installed over metal pan treads with a carpet back..

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.5 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

D. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

E. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a 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.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 Section "High-Performance Coatings."

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

G. Welded Wire Fabric: ASTM A 185, 6 by 6 inches (152 by 152 mm)--W1.4 by W1.4, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts,[**railings,**] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections 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. Weld exposed corners and seams continuously, unless otherwise indicated.
5. 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.

G. 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.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.8 STEEL-FRAMED STAIRS

A. Available Manufacturers:

1. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel channels.

   a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channel headers and miscellaneous framing members as indicated.
3. Weld stringers to headers; weld framing members to stringers and headers.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch (1.7 mm).

1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.
4. Attach abrasive nosings to risers.

2.9 STAIR RAILINGS

A. Comply with applicable requirements in Division 5 Section "Pipe and Tube Railings" for railings, and as follows:

1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.

2.10 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete 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.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, 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 nonmetallic, nonshrink grout, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For hollow masonry anchorage, use toggle bolts.
4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

END OF SECTION 05511

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 the following:

1. Aluminum tube railings.

B. Related Sections include the following:

1. Division 5 Section "Metal Stairs" for steel tube railings associated with metal stairs.
2. Division 6 Section "Miscellaneous Carpentry" for wood blocking for anchoring railings.
3. Division 9 Section "Gypsum Board Assemblies" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: 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. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. 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. Manufacturer's product lines of mechanically connected railings.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. 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 Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of finishing members at intersections.

E. Welding certificates.

F. Qualification Data: For professional engineer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

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 the following:

1. 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.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings 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 AND SCHEDULING

A. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

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. Aluminum Pipe and Tube Railings:

   a. AlumaGuard Corp.
   b. ATR Technologies, Inc.
   c. Blum, Julius & Co., Inc.
   d. Braun, J. G., Company; a division of the Wagner Companies.
   e. CraneVeyor Corp.
   f. Hollaender Manufacturing Company.
   g. Moultrie Manufacturing Company.
   h. Pisor Industries, Inc.
   i. Sterling Dula Architectural Products, Inc.
   j. Superior Aluminum Products, Inc.
   k. Thompson Fabricating, LLC.
   l. Tubular Specialties Manufacturing, Inc.
   m. Tuttle Aluminum & Bronze.
   n. 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. Brackets, 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, General: 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 Structural Round Tubing: ASTM B 429, Alloy 6063-T6.

C. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 FASTENERS

A. General: Provide the following:

1. Aluminum Railings: Type 316 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.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Shop Primers: Provide primers that comply with Division 9 Section "High-Performance Coatings."

2.6 FABRICATION

A. General: 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. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

A. 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.

B. Form changes in direction as follows:

1. By radius bends of radius indicated.

C. 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.

D. Close exposed ends of railing members with prefabricated end fittings.

E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

G. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

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. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 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 (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

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.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

3.4 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For steel-framed gypsum board partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.5 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

3.6 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 05521

SECTION 06105 - MISCELLANEOUS 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. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking, cants, and nailers.
4. Interior wood trim.
5. Wood shelving and clothes rods.
6. Plywood backing panels.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 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 treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Dimension lumber framing.
2. Miscellaneous lumber.
3. Interior wood trim.
4. Shelving and clothes rods.

1.6 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.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

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

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

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

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

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

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

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

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
4. Use Interior Type A, unless otherwise indicated.

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

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

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

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof construction.
4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB, or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.

7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Standard or 3 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

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

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

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

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

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

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to 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 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

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

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach carpentry work to substrate by anchoring and 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.

J. 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 to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

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

3.3 PROTECTION

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

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

END OF SECTION 06105

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. Building Paper.
3. Building wrap.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for plywood backing panels.

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. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
6. 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. Preservative-treated plywood.

2. Fire-retardant-treated plywood.
3. Building wrap.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1. Plywood.
2. Oriented strand board.
3. Fiberboard wall sheathing.
4. Particleboard underlayment.
5. Hardboard underlayment.

1.5 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 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
4. Use Interior Type A, unless otherwise indicated.

B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat plywood indicated on Drawings.

2.2 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch (13 mm).

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm)] thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

2.3 FASTENERS

A. General: 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 of Type 304 stainless steel.

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

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

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening 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 Gypsum 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. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

2.4 WEATHER-RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. 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 according to 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:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

3. Water-Vapor Permeance: Not less than 152 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
4. Allowable UV Exposure Time: Not less than three months.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

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."
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."

6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

D. 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. Install fasteners without splitting wood.

E. Coordinate wall 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. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

1. Comply with "Code Plus" installation provisions in guide referenced in paragraph above.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Screw to cold-formed metal framing.
c. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.4 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) 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 (100-mm) overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. 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.

3.5 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply

sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.6 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (100 mm), 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.

3.7 PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06160

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

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. Plastic-laminate cabinets.
2. Plastic-laminate countertops.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

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 high-pressure decorative laminate 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.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

G. Qualification Data: For 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 licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Fabricator of products.

C. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

D. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

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 woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating 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 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural woodwork that may be incorporated into the Work include, but are not limited to, the following: **Kitchen Craft**

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Particleboard: ANSI A208.1, Grade M-2.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

a. Abet Laminati, Inc.
b. Arborite; Division of ITW Canada, Inc.
c. Formica Corporation.
d. Lamin-Art, Inc.
e. Nevamar Company, LLC; Decorative Products Div.
f. Panolam Industries International Incorporated.
g. Westinghouse Electric Corp.; Specialty Products Div.
h. Wilsonart International; Div. of Premark International, Inc.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Naming Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.

C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Drawer Slides: BHMA A156.9, B05091.

1. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted; full-extension type; zinc-plated steel with polymer rollers.

G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 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 nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion 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: 30 g/L.
2. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. 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.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

D. Complete fabrication, 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.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. 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.

1. Seal edges of openings in countertops with a coat of varnish.

2.6 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. WI Construction Style: Style A, Frameless.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: Grade VGS.

F. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

   a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
   b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

H. 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. As selected by Architect from laminate manufacturer's full range in the following categories:

   a. Wood grains, matte finish.

I. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGP.

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 manufacturer's full range in the following categories:

a. Wood grains, matte finish.
b. Patterns, matte finish.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard or medium-density fiberboard.

G. Core Material at Sinks: Particleboard made with exterior glue or exterior-grade plywood.

H. Paper Backing: Provide paper backing on underside of countertop substrate.

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 fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to 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 inch in 96 inches (3 mm in 2400 mm).

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 or finishing screws 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 openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with 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. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Calk 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.

I. Refer to Division 9 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

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 semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

SECTION 07210 - BUILDING INSULATION

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. Concealed building insulation.
2. Vapor retarders.

B. Related Sections include the following:

1. Division 9 Section "Gypsum Board Assemblies for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials 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.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Products: Subject to compliance with requirements, provide one of the products specified.

3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS-FIBER BLANKET INSULATION

A. Available Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or polypropylene-scrim-kraft vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches (89 mm) thick with a thermal resistance of [11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C)] [13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C)].
2. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
3. 5-1/2 inches (140 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).
4. 6-1/2 inches (165 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).

2.3 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.4 INSULATION FASTENERS

A. Insulation Anchors, Spacers, Washers and standoff to match existing construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

E. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Install 3-inch- (76-mm-) thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches (1219 mm) on either side of partition.

3.6 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.7 INSULATION SCHEDULE

A. Insulation Type 1: Unfaced, glass-fiber blanket insulation.

B. Insulation Type 2: Faced, glass-fiber blanket insulation.

END OF SECTION 07210

SECTION 07411 - METAL ROOF PANELS

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. Factory-formed and field-assembled standing-seam metal roof panels.
2. Metal soffit panels.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal roof panels.
2. Division 7 Section "Metal Wall Panels" for factory-formed metal soffit panels.
3. Division 7 Section "Sheet Metal Flashing and Trim" for fasciae, copings, flashings and other sheet metal work not part of metal roof panel assemblies.
4. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

B. Solar Flux: Direct and diffuse radiation from the sun received at ground level over the solar spectrum, expressed in watts per square meter.

C. Solar Reflectance: Fraction of solar flux reflected by a surface, expressed as a percent or within the range of 0.00 and 1.00.

D. Steel Sheet Thickness: Minimum thickness of base metal without metallic coatings or painted finishes.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft. (75 Pa).
2. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft. (75 Pa).
3. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

C. Water Penetration: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
2. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa).
3. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

D. Water Absorption: Maximum 1.0 percent absorption rate by volume when tested according to ASTM C 209.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

F. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

   a. Uniform pressure of 20 lbf/sq. ft., acting inward or outward.
   b. Uniform pressure as indicated on Drawings.

2. Snow Loads: 20 lbf/sq. ft.
3. Deflection Limits: Engineer metal roof panel assemblies to withstand design loads with vertical deflections no greater than 1/240 of the span.

G. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

H. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

a. Flashing and trim.
b. Gutters.
c. Downspouts.
d. Roof curbs.
e. Snow guards.
f. Flashing of penetrations.

2. 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. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:

1. Roof panels and attachments.
2. Purlins and rafters.
3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

D. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Roof and Soffit Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, clips, battens, closures, and other metal roof panel accessories.
2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.

F. Qualification Data: For Installer.

G. Material Certificates: For thermal insulation and vapor retarders, signed by manufacturers.

H. Field quality-control inspection reports.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Roof and Soffit Panels: Include reports for air infiltration, water penetration, thermal performance, and structural performance.

J. Maintenance Data: For metal roof panels to include in maintenance manuals.

K. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing metal roof panel assemblies and providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for metal roof panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of metal roof panel and accessories from manufacturer of existing panels.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of purlins and rafters, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide Panels by manufacturer of the panels of the existing construction.

2.2 PANEL MATERIALS

A. Provide Panel Materials that match existing construction.

B. Panel Sealants: Match existing.

2.3 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL ROOF PANELS

A. Match existing.

2.4 MISCELLANEOUS METAL FRAMING

A. General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

B. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: 1-1/2 inches (38 mm).

C. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (13-mm-) wide flange.

1. Depth: As indicated.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

E. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.

2.6 STANDING-SEAM METAL ROOF PANELS

A. Products in this Article are field assembled.

1. Match Existing.

2.7 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

1. Manufacturers:

a. AEP-Span.
b. Architectural Building Components.
c. ATAS International, Inc.
d. Berridge Manufacturing Company.
e. BHP Steel Building Products USA Inc.
f. CENTRIA Architectural Systems.
g. Copper Sales Inc.

h. Custom Panel Industries, LLC.
i. Delcoa Industries, Inc.
j. Fabral, Inc.
k. Innovative Metals Company, Inc.
l. K-Metals Inc.
m. MBCI; Div. of NCI Building Systems.
n. Merchant & Evans, Inc.
o. Metal-Fab Manufacturing, LLC.
p. Metal Sales Manufacturing Corporation.
q. Modern Metal Systems, Inc.
r. Petersen Aluminum Corporation.

2. Material: Zinc-coated (galvanized) steel sheet, 0.0209 inch (0.55 mm) thick.

   a. Exterior Finish: Siliconized polyester.
   b. Color: Finish and color as selected by architect from manufacturer's full range.

2.8 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
   3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- (0.64-mm-) thick, stainless-steel or nylon-coated aluminum sheet.
   4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, sized according to SMACNA's "Architectural

Sheet Metal Manual." Furnish gutter supports spaced 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match existing gutters.

D. Downspouts: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- (3-m-) long sections, complete with formed elbows and offsets. Finish downspouts to match existing downspouts.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.9 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.

3.3 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.
2. Install panels perpendicular to purlins.
3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
4. Provide metal closures at peaks and each side of ridge and hip caps.
5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install ridge and hip caps as metal roof panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of aluminum roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet (1.2 m) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform inspections and prepare reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07411

SECTION 07412 - METAL WALL PANELS

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. Factory-formed and field-assembled, exposed-fastener, lap-seam metal wall panels.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal wall panels.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashings and other sheet metal work not part of metal wall panel assemblies.
3. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITIONS

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight system.

B. Steel Sheet Thickness: Minimum thickness of base metal without metallic coatings or painted finishes.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

D. Water Absorption: Maximum 1.0 percent absorption rate by volume when tested according to ASTM C 209.

E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure of 12 lbf/sq. ft., acting inward or outward.

2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/240 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.

a. Test Pressures: 150 percent of inward and outward wind-load design pressures.

F. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads.".

G. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

a. Flashing and trim.

2. 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 Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Vapor Retarders: 6-inch- (150-mm-) square Samples.
4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
5. Exposed Gaskets: 12 inches (300 mm) long.
6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.

E. Qualification Data: For Installer.

F. Material Certificates: For thermal insulation, signed by manufacturers.

G. 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. Field quality-control test reports.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Wall Panels: Include reports for air infiltration, water penetration, and structural performance.

J. Maintenance Data: For metal wall panels to include in maintenance manuals.

K. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. 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 manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

      a. Perform tests under environmental conditions replicating those that will exist during installation.

   2. Submit no fewer than nine pieces of each type 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 the use of specially formulated primers.

F. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

   1. Combustion Characteristics: ASTM E 136.
   2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
   3. Metal wall panels shall be identified with appropriate markings of applicable testing and inspecting agency.

G. Surface-Burning Characteristics: Provide insulated metal wall panels having insulation-core materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

   1. Flame-Spread Index: 25 or less, unless otherwise indicated.

2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

E. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Siliconized Polyester Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 15 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 2 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

3. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Weathertight Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
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 manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
5. Basis-of-Design Products: The design for each metal wall panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Surface: Match existing finish.
3. Exposed Finishes: Match existing.
4. Concealed Finish: Match Existing.

B. Panel Sealants:

1. 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 (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL WALL PANELS

A. Refer to Division 7 Section "Building Insulation."

B. Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.

C. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:

1. Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing.
2. Available Manufacturers:

   a. CGI Silvercote, Inc.
   b. Lamtec Corporation.
   c. Mizell Bros. Co.

D. Retainer Strips: 0.019-inch- (0.5-mm-) thick, formed, galvanized steel or PVC retainer clips colored to match insulation facing.

2.4 MISCELLANEOUS METAL FRAMING

A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.

B. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, metallic-coated steel sheet.

C. Zee Clips: 0.079-inch (2.0-mm) bare steel thickness, cold-formed, galvanized steel sheet.

D. Base or Sill Angles: 0.079-inch (2.0-mm) bare steel thickness, cold-formed, galvanized steel sheet.

E. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (13-mm-) wide flange.

1. Depth: As indicated.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

G. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.

1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.

2.6 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Vee-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.

1. Basis-of-Design Product: Match Existing by a comparable product of one of the following:
2. Available Manufacturers:

a. BHP Steel Building Products USA Inc.
b. CENTRIA Architectural Systems.
c. Copper Sales Inc.
d. Custom Panel Industries, LLC.
e. Fabral, Inc.
f. Flexospan Steel Buildings, Inc.
g. Industrial Building Panels, Inc.
h. MBCI; Div. of NCI Building Systems.
i. McElroy Metal, Inc.
j. Metal Sales Manufacturing Corporation.
k. Morin Corporation; a Metecno Group Company.

l. Reynolds Metals Company.
m. United Steel Deck, Inc.; Subsidiary of Bouras Industries, Inc.

3. Material: Zinc-coated (galvanized) steel sheet, match existing thickness.

a. Exterior Finish: match existing.
b. Color: match existing.

4. Rib Spacing: match existing.
5. Panel Coverage: match existing.
6. Panel Height: match existing.

2.7 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.8 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.

3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

1. Coat back side of aluminum or stainless-steel wall panels with bituminous coating where wall panels will contact wood, ferrous metal, or cementitious construction.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.4 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL WALL PANELS

A. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:

1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths with both sets of facing tabs sealed to provide a complete vapor retarder. Comply with the following installation method:
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation with both sets of facing tabs sealed to provide a complete vapor retarder. Comply with the following installation method:

    a. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.

5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.5 FIELD-ASSEMBLED METAL WALL PANEL INSTALLATION

A. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
7. At panel splices, nest panels with minimum 6-inch (150-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

B. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

C. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install thermal barrier, in number of layers required for fire rating, over subgirts, attached with thermal-barrier fasteners. Install second set

of subgirts horizontally, fastened through thermal barrier into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.

1. Comply with UL requirements for fire-rated construction.

D. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

E. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent 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. (300 Pa).

C. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.

E. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07412

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Formed wall flashing and trim.
2. Formed overhead-piping safety pans.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
2. Division 7 Section "Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
3. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

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.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify 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 fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories 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 (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive 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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Finish: No. 2D (dull, cold rolled).

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.4 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.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

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, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. 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.

C. Fabricate 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.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 8 inches beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Stainless Steel: 0.0156 inch (0.4 mm) thick.

B. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 8 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Stainless Steel: 0.0156 inch (0.4 mm) thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Stainless Steel: 0.0250 inch (0.65 mm) thick.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Torch cutting of sheet metal flashing and trim is not permitted.

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 fabricator or manufacturers of dissimilar metals.

1. Coat 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 underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. 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.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting

proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Pretinning is not required for zinc-tin alloy-coated stainless steel and lead.
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 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. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

C. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 8 inches beyond wall openings.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

3.5 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 and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. 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 07620

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. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between metal panels.
d. Joints between different materials listed above.
e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
f. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Perimeter joints of exterior openings where indicated.
b. Perimeter joints between interior wall surfaces and frames of interior doors.
c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
d. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.
b. Other joints as indicated.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

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. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Qualification Data: For Installer.

F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

G. 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. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants 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.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.6 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 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the 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 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 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 sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Neutral-Curing Silicone Sealant ES-1:

1. Available Products:

a. Dow Corning Corporation; 790.
b. GE Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 864.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

   a. Use O Joint Substrates: color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, granite, limestone, marble and ceramic tile.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

D. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant ES-2:

1. Available Products:

   a. Pecora Corporation; 898.
   b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

   a. Use O Joint Substrates: Coated glass and ceramic tile.

2.4 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining 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.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous 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 in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

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 according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
    b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, Method B, Exposed Surface Finish Hand Pull Tab, Method C, Field-Applied Sealant Joint Hand Pull Flap or Method D, Water Immersion in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

    a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free of voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-1: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Single-component neutral-curing silicone sealant ES-1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application JS-2: Exterior butt joints between metal panels.

1. Joint Sealant: Single-component neutral-curing silicone sealant ES-1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Joint-Sealant Application JS-3: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant ES-2.
2. Joint-Sealant Color: White.

D. Joint-Sealant Application JS-4: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

1. Joint Sealant: Single-component neutral-curing silicone sealant ES-1.
2. Joint-Sealant Color: Clear - Paintable

END OF SECTION 07920

SECTION 08111 - STANDARD STEEL 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Sections include the following:

1. Division 8 Sections for door hardware for standard steel doors.
2. Division 9 painting Sections for field painting standard steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details.
3. Frame details for each frame type, including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Details of glazing frames and stops showing glazing.
8. Details of conduit and preparations for electrified door hardware and controls.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

E. Oversize Construction Certification: For standard steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies; include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify openings 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 opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

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. Amweld Building Products, LLC.
2. Benchmark Doors; a division of General Products Co., Inc.
3. Ceco Door Products; an ASSA ABLOY Group Company.
4. CURRIES Company; an ASSA ABLOY Group Company.
5. Deansteel Manufacturing, Inc.
6. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
7. Kewanee Corporation (The).
8. Mesker Door Inc.
9. Pioneer Industries, Inc.
10. Republic Builders Products Company.
11. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

C. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

D. 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 standard steel door frames of type indicated.

E. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

F. 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. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

2.3 STANDARD STEEL 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 A250.8.

1. Design: Flush Panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

    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 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W) when tested according to ASTM C 1363.

        1) Locations: Exterior doors and interior doors where indicated.

3. Vertical Edges for Single-Acting Doors: Square edge unless beveled edge is indicated.

    a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model 1 (Full Flush).

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

E. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

H. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.

I. Plaster Guards: Formed from same material as frames, not less than 0.016-inch (0.4-mm) thick.

2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.6 FABRICATION

A. General: Fabricate standard steel doors and frames 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. Standard Steel 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. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) in height.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
        5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare standard steel doors and frames 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 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

D. Stops and Moldings: Provide stops and moldings around glazed lites 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 door or frame.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

E.

2.7 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

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 standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), 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: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.

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 due to 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 plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Standard Steel 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 (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

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 standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames 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 primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.

B. Related Sections include the following:

1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.

3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors.

C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

D. Fire-Rated Wood Doors: Doors 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.

1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
2. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.
3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a

42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
   a. Solid-Core Interior Doors: Life of 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. Flush Wood Doors:

   a. Algoma Hardwoods Inc.
   b. Ampco Products, Inc.
   c. Buell Door Company.
   d. Chappell Door Co.
   e. Eagle Plywood & Door Manufacturing, Inc.
   f. Eggers Industries; Architectural Door Division.
   g. GRAHAM Manufacturing Corp.
   h. Haley Brothers, Inc.
   i. Ideal Wood Products, Inc.
   j. IPIK Door Company.
   k. Lambton Doors.
   l. Marlite.
   m. Mohawk Flush Doors, Inc.
   n. Oshkosh Architectural Door Co.
   o. Poncraft Door Co.
   p. Southwood Door Co.
   q. Vancouver Door Company, Inc.
   r. VT Industries Inc.
   s. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Adhesives: Do not use adhesives containing urea formaldehyde.

B. Doors for Transparent Finish:

1. Grade: Premium, with Grade AA faces.
2. Species and Cut: White birch, rotary cut.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Center balance match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 10 feet (3 m) or more.
7. Stiles: Same species as faces or a compatible species.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-1.

   a. Use particleboard made with binder containing no urea-formaldehyde resin.

1. Blocking: Provide wood blocking in particleboard-core doors as follows:

   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
   c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.5 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Transparent Finish: Shop seal faces and edge of doors, including cutouts, with stain (if required), other required pretreatments, and first coat of finish as specified in Division 9 Section "Painting."

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing.

B. Finish doors at factory.

C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

D. Transparent Finish:

1. Grade: Custom.
2. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-6 catalyzed polyurethane.
3. Staining: Match Architect's sample.
4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

   a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.

3. Exterior and interior aluminum door frames.

B. Related Sections include the following:

1. Division 7 Section "Building Insulation" for insulation materials field installed with aluminum-framed systems.
2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
4. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

   a. Deflection exceeding specified limits.
   b. Thermal stresses transferred to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: 14psf for components and cladding.
2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
2. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

F. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).

b. Test Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
c. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

I. Water Penetration Under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

1. Maximum Water Leakage: According to AAMA 501.1. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

K. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

L. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having minimum STC 32 according to ASTM E 413 and an OITC 26 according to ASTM E 1332, as determined by testing according to ASTM E 90.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Welding certificates.

G. Qualification Data: For Installer and testing agency.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

I. Field quality-control test and inspection reports.

J. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

K. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

F. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems 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 aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for aluminum-framed systems is based on Vistawall – Storefronts (Series 3000 Multiplane). Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Arch Aluminum & Glass Co., Inc.
2. CMI Architectural Products, Inc.
3. Commercial Architectural Products, Inc.
4. EFCO Corporation.
5. Kawneer.
6. Pittco Architectural Metals, Inc.
7. Tubelite Inc.
8. United States Aluminum.
9. Vistawall Architectural Products.
10. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermal Center Set Storefront System.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type and as follows:

1. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.

   a. Color: As selected by Architect from manufacturer's full range of colors.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by structural- and weatherseal-sealant and aluminum-framed system manufacturers for this use.

a. Color: Matching structural sealant.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.

   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

B. Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.7 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker complying with AAMA 611.

1. Color: Black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
b. Install weatherseal sealant according to Division 7 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.

END OF SECTION 08411

SECTION 08510 - STEEL WINDOWS

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. Cold-formed, welded steel windows.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for sealing perimeter joints between windows and adjacent materials.
2. Division 8 Section "Glazing" for glazing requirements for steel windows, including those specified to be factory glazed.
3. Division 8 Section "Security Glazing" for security glazing requirements for steel windows, including those specified to be factory glazed.
4. Division 9 Section "Painting" for field painting of factory prime-coated windows.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for steel windows.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:

1. Layout and installation details, including anchors.
2. Elevations of continuous work at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
3. Full-size section details of typical composite members, including reinforcement.
4. Hardware, including operators.
5. Accessories.
6. Glazing details.
7. 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 Initial Selection: For units with factory-applied color finish.

1. Include Samples of window hardware and accessories involving color selection.

D. Samples for Verification: For each type of steel window required, prepared on Samples of size indicated below.

1. Main Framing Member: 12-inch- (300-mm-) long, full-sized sections, with glazing stop and weather stripping.
2. Architect reserves the right to require additional Samples that show fabrication techniques, workmanship, and design of hardware and accessories.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for steel window manufacturer's standard products to determine compliance with performance requirements.

F. Warranties: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to steel window manufacturer for installation of units required for this Project.

B. SWI Publication: Comply with applicable requirements in SWI's "The Specifier's Guide to Steel Windows" except where more stringent requirements are indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify steel window openings 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 opening dimensions and proceed with fabricating steel windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection.
c. Water leakage or air infiltration.
d. Faulty operation of operable sash and hardware.

e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
f. Insulating-glass failure.

2. Warranty Period: Two year(s) from date of Substantial Completion.
3. Warranty Period for Metal Finishes: 10 years from date of Substantial Completion.
4. Warranty Period for Glass: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cold-Formed Steel Windows:

a. DV Fyre-Tec, Inc.
b. Optimum Window Manufacturing Corp.

2.2 MATERIALS

A. Cold-Formed Steel Window Members: Provide frame and ventilator members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members, comply with the following requirements:

1. Commercial and Industrial Windows: Not less than 2.75 lb/ft. (4.09 kg/m) in combined weight, and not less than 1-1/4 inches (32 mm) deep.

B. Glazing beads shall be manufacturer's standard**.**

C. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal, that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of steel windows.

1. Exposed Fasteners: If exposed fasteners are used, provide Phillips flat-head machined screws that match finish of member or hardware being fastened, as appropriate.

D. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123. Provide units with sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and to be completely concealed when steel window is closed.

1. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
2. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
3. Weather-Stripping Material: Manufacturer's standard material.

F. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

A. Glass: Uncoated clear float glass complying with Division 8 Section "Glazing."

2.4 FABRICATION

A. General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.

B. Window Types: Provide the following types of steel windows:

1. Fixed windows.

C. Glazing Beads: Provide screw-applied glazing beads; coordinate with glass selection and glazing system as indicated. Finish glazing beads to match window units if fabricated of steel; otherwise, provide manufacturer's standard finish.

D. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Refer to Division 8 Section "Glazing" for glass units and glazing requirements.

2.5 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Surface Preparation: Clean surfaces of dirt, oil, grease, scale, and other contaminants; follow with a zinc-phosphate pretreatment applied according to window manufacturer's written recommendations.

C. Shop Prime Coat Finish: After fabrication, provide manufacturer's standard epoxy prime coat of 1.0-mil (0.03-mm) dry film thickness, and oven dry for 30 minutes at 300 deg F (150 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances, rough opening dimensions, levelness of sill plate, coordination with wall flashings and vapor retarders, and other conditions affecting performance of work.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.

B. Install windows level, plumb, and true to line, without distortion. Anchor securely to surrounding construction with approved fasteners.

1. Separate corrodible surfaces subject to electrolytic action at points of contact with other materials.

C. Set sill members in a bed of sealant or with gaskets, as indicated, for weathertight construction.

1. Seal exterior joints between window frame and opening substrate with sealant.

D. Repair abraded areas of factory-applied finishes.

3.3 CLEANING AND PROTECTION

A. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

B. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08510

SECTION 08582 - SECURITY WINDOWS

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 transaction/ticket security windows.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide security windows that comply with performance requirements specified as determined by testing manufacturer's standard assemblies representing those indicated for this Project.

B. Design Requirements: Comply with structural performance, air infiltration, and water penetration requirements indicated.

1. Testing: Test each type and size of security window manufactured for Project through a qualified testing agency for compliance with specified performance requirements.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for security windows.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other Work, and the following:

1. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
2. Glazing details.
3. Details of half round ticket window, speaking aperture, and shelf.

C. Samples for Initial Selection: For typical frame members with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Framing: 12-inch- (300-mm-) long sections of frame members.

E. Qualification Data: For Installer.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of security window manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain security windows through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of security windows and are based on the specific system indicated.

1. Do not modify intended security performance or aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. 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 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with location in Project.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify security window openings 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 opening dimensions and proceed with fabricating security windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for security windows. Deliver such items to Project site in time for installation.

1.9 SEQUENCING

A. Field Painting: Except where security windows have been preglazed before installation, complete field painting of security windows before glazing installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of security windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including deflections exceeding 1/4 inch (6 mm).
2. Failure of welds.
3. Excessive air leakage.
4. Faulty operation of window hardware.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

B. Warranty Period: Three years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Security Fasteners: Furnish not less than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

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 manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
3. Basis-of-Design Product: The design for each security window is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.125 inch (3.2 mm) thick at any location for main frame and sash members.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Cold-Rolled Steel Sheet: ASTM A 366/A 366M.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) zinc (galvanized) coating.

E. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

F. Concealed Bolts: ASTM A 307, Grade A, unless otherwise indicated.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

H. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.

I. Sealants: For sealants required within fabricated security windows, provide type recommended by the manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.

2.3 FIXED, TRANSACTION SECURITY WINDOWS

A. Basis-of-Design Product: Feelsafer.com – SP3624N

B. Configuration: One fixed glazed panel.

C. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
   1. Material: Extruded aluminum with Class I, clear anodized finish.
   2. Profile: Manufacturer's standard.
   3. Framing Depth: Manufacturer’s Standard.

2.4 ACCESSORIES

A. Half Moon Slot Ticket Service Window:

   1. Dimensions: 6” Radius.
   2. Operation: Manual.

B. Speaking Apertures: Fabricate from Satin Anodized Finish Aluminum, designed to allow passage of speech at normal speaking volume without distortion.

1. Shape: Circular.

2.5 FABRICATION

A. General: Fabricate security windows to comply with indicated standards. Include a complete system for assembly of components and anchorage of security windows.

1. Provide security windows that are reglazable from the secure side without dismantling the nonsecure side of framing.
2. Prepare security windows for glazing unless preglazing at the factory is indicated.

B. Framing: Miter or cope corners the full depth of framing; weld, and dress smooth.

1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

C. Glazing Stops: Finish glazing stops to match security window framing.

1. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.
2. Nonsecure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.

D. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

E. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

F. Factory-cut openings in glazing for speaking apertures.

G. Preglazed Fabrication: Preglaze security windows at the factory where possible and practical for applications indicated. Comply with requirements in Division 8 Section "Security Glazing."

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.8 STAINLESS-STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish.

1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Intermediate Polish Finish: No. 3 finish.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction.

B. Removable Glazing Stops and Trim: Fasten components with security fasteners.

C. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Remove and replace security window work where inspections indicate that work does not comply with specified requirements.

C. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.

3.4 ADJUSTING

A. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.5 CLEANING

A. Clean surfaces promptly after installation of security windows. Exercise care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

1. Lubricate sliding security window hardware.

END OF SECTION 08582

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 the following:

1. Commercial door hardware for the following:

a. Swinging doors.
b. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. Related Sections include the following:

1. Division 8 Section "Standard Steel Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Division 8 Section "Flush Wood Doors" for astragals and integral intumescent seals provided as part of fire-rated labeled assemblies.
3. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.
4. Division 13 Section "Security Access" for access control devices installed at door openings and provided as part of a security access system.
5. Division 13 Section "Fire Alarm" for connections to building fire alarm system.
6. Division 16 Sections for connections to electrical power system and for low-voltage wiring work.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Pivots, thresholds, weather stripping and cylinders for locks specified in other Sections.
2. Permanent cores to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.

C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.

1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks and closers.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

G. Warranty: Special warranty specified in this Section.

H. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.
9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

10) List of related door devices specified in other Sections for each door and frame.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

d. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: 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.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including excessive deflection, cracking, or breakage.
    b. Faulty operation of operators and door hardware.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:
    a. Exit Devices: Two years from date of Substantial Completion.
    b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide **six** months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those 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 this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. 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. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

E. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:

1. Baldwin Hardware Corporation (BH).
2. Hager Companies (HAG).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." And FED-STD-795, "Uniform Federal Accessibility Standards."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:

1. Levers: Wrought stainless steel.
2. Escutcheons (Roses): Wrought stainless steel.
3. Dummy Trim: Match lever lock trim and escutcheons.
4. Lockset Designs: Hagar Companies, Inc. Whitnell Design or, if sets are provided by another manufacturer, provide designs that match those designated.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

E. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
5. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.5 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and FED-STD-795, "Uniform Federal Accessibility Standards."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: 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.

F. Available Manufacturers:

1. Adams Rite Manufacturing Co. (ARM).
2. Arrow USA; an ASSA ABLOY Group company (ARW).
3. Cal-Royal Products, Inc. (CRP).
4. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
5. Detex Corporation (DTX).
6. Door Controls International (DCI).
7. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
8. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
9. Locknetics; an Ingersoll-Rand Company (LSE).
10. Monarch Exit Devices & Door Hardware; an Ingersoll-Rand Company (MON).
11. Precision Hardware, Inc. (PH).
12. Rutherford Controls Int'l. Corp. (RCI).
13. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
14. Von Duprin; an Ingersoll-Rand Company (VD).
15. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.6 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 2.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

   a. Replace construction cores with permanent cores as directed by Owner.

E. Manufacturer: Same manufacturer as for locks and latches.

F. Available Manufacturers:

1. ABLOY Security, Inc.; an ASSA ABLOY Group company (ABL).
2. Arrow USA; an ASSA ABLOY Group company (ARW).
3. ASSA, Inc.; an ASSA ABLOY Group company (ASA).
4. Best Access Systems; Div. of The Stanley Works (BAS).
5. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
6. Falcon Lock; an Ingersoll-Rand Company (FAL).
7. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
8. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
9. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
10. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
11. Hagar Companies, Inc. (HAG).

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

   a. Notation: **"DO NOT DUPLICATE."**

2. Quantity: In addition to one extra key blank for each lock, provide the following:

   a. Cylinder Change Keys: Three.
   b. Master Keys: Five.

2.8 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Available Manufacturers:

1. Burns Manufacturing Incorporated (BM).
2. Don-Jo Mfg., Inc. (DJO).
3. Forms + Surfaces (FS).
4. Hager Companies (HAG).
5. Hiawatha, Inc. (HIA).
6. IVES Hardware; an Ingersoll-Rand Company (IVS).
7. Rockwood Manufacturing Company (RM).
8. Trimco (TBM).

2.9 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and FED-STD-795, "Uniform Federal Accessibility Standards."

1. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4 Grade 1 unless Grade 2 is indicated. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Available Manufacturers:

a. Arrow USA; an ASSA ABLOY Group company (ARW).
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
c. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
d. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
e. LCN Closers; an Ingersoll-Rand Company (LCN).
f. Norton Door Controls; an ASSA ABLOY Group company (NDC).
g. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
h. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
i. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
j. Hagar Companies, Inc. (HAG).

2.10 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets, unless otherwise indicated.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material indicated in door hardware sets.

1. Available Manufacturers:

a. American Floor Products Co., Inc. (AFP).
b. Baldwin Hardware Corporation (BH).
c. Burns Manufacturing Incorporated (BM).
d. Don-Jo Mfg., Inc. (DJO).
e. Hager Companies (HAG).
f. Hiawatha, Inc. (HIA).
g. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation (IPC).
h. IVES Hardware; an Ingersoll-Rand Company (IVS).
i. Pawling Corporation (PAW).
j. Rockwood Manufacturing Company (RM).
k. Trimco (TBM).

2.11 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16 Grade 1 unless Grade 2 is indicated.

1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

C. Available Manufacturers:

1. Architectural Builders Hardware Mfg., Inc. (ABH).
2. Baldwin Hardware Corporation (BH).
3. Hager Companies (HAG).
4. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.12 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

F. Available Manufacturers:

1. Hager Companies (HAG).
2. M-D Building Products, Inc. (MD).
3. National Guard Products (NGP).
4. Pemko Manufacturing Co. (PEM).
5. Reese Enterprises (RE).
6. Sealeze; a unit of Jason Incorporated (SEL).
7. Zero International (ZRO).

2.13 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and FED-STD-795, "Uniform Federal Accessibility Standards."

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. Available Manufacturers:

1. Hager Companies (HAG).
2. M-D Building Products, Inc. (MD).
3. National Guard Products (NGP).
4. Pemko Manufacturing Co. (PEM).
5. Reese Enterprises (RE).
6. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
7. Sealeze; a unit of Jason Incorporated (SEL).
8. Zero International (ZRO).

2.14 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.15 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, 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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise 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. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's 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.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed 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.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 1 Section "Demonstration and Training."

3.8 DOOR HARDWARE SETS

Door Hardware Set No. 1 (Office)
Door No. 204,220a,222,224,227-240,242,249,251-253; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim	Model #3550 2 ¾" US26D WTN SCC KD ASA	Hagar Companies	US26D
[1]	Stops and Holders	Model #236W	Hagar Companies	US26D

Door Hardware Set No. 2 (Bathroom)
Door No. 214,215,247,248; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1 ea.]	Operating Trim	Pull Plate Model #102G (4"x16")	Hagar Companies	US26D
		Push Plate Model #100T (4"x16")	Hagar Companies	US26D
[1]	Closing Devices	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D
[2]	Protective Trim Units	Kick Plate Model # 193S	Hagar Companies	US26D
[1]	Stops and Holders	Model #236W	Hagar Companies	US26D
[1]	Signage	368M or 368W	Hagar Companies	B/W

Door Hardware Set No. 3 (Passage)
Door No. 203,205,207-209,211,213,218,220b,221,225,226,241,243-246,250; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim	Model #3510 2 ¾" US26D WTN ASA	Hagar Companies	US26D
[1]	Stops and Holders	Model #236W	Hagar Companies	US26D

Door Hardware Set No. 4 (Entry-Aluminum Storefront)
Door No. 201,202; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[2]	Operating Trim / Exit Device	Model #4501 SVR 0 36" US19 1 ¾" Trim: 45 CE WTN US19 1 ¾"	Hagar Companies	US19
[1]	Automatic Operator	SW100	Besam	Bronze
	Weather Stripping	Manufacturer's Standard		
[2]	Door Sweeps	Manufacturer's Standard		
[1]	Threshold	Manufacturer's ADA Standard		

Door Hardware Set No. 5 (Entry – Insulated Steel)
Door No. 206,219; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim / Exit Device	Model #4501 SVR 0 36" US26D 1 ¾" Trim: 45 CE WTN US26D 1 ¾"	Hagar Companies	US26D
[1]	Closing Devices	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D
	Weather Stripping	785S	Hagar Companies	
[1]	Door Sweep	806S	Hagar Companies	MIL.
[1]	Threshold	Model #403s	Hagar Companies	MIL.

Door Hardware Set No. 6 (Exit)
Door No. 212,255; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim / Exit Device	Model #4501 SVR F 36" US26D 1 ¾" Trim: 45 BE WTN US26D 1 ¾"	Hagar Companies	US26D
[1]	Closing Devices	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D

Door Hardware Set No. 7 (Bath)
Door No. 216,217; each to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim	Model #3550 2 ¾" US26D WTN SCC KD ASA	Hagar Companies	US26D
[1]	Stops and Holders	Model #236W	Hagar Companies	US26D
[1]	Closing Devices	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D

Door Hardware Set No. 8 (Passage)
Door No. 210 to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[1]	Operating Trim	Model #3510 2 ¾" US26D WTN ASA	Hagar Companies	US26D
[1]	Closing Device	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D

Door Hardware Set No. 9 (Exit)
Door No. 254; to have the following:

No.	Item	Description	Manufacturer	Finish
*	Hanging Devices	Model #1191 (4 ½"x4 ½")	Hagar Companies	US26D
[2]	Operating Trim / Exit Device	Model #4501 RIM F 36" US26D 1 ¾" Trim: 45 BE WTN US26D 1 ¾"	Hagar Companies	US26D
[2]	Closing Devices	Model #5200 PAR 25 US26D HD SLC with DLY	Hagar Companies	US26D
[1]	Gravity Coordinator	Model # 298D	Hagar Companies	US26D

END OF SECTION 08710

SECTION 08716 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Low-energy, power-operating door operators.

B. Related Sections include the following:

1. Division 8 door Sections for doors that need reinforcement for automatic door operators.
2. Division 16 Sections for electrical connections including conduit and wiring for automatic door operators.

1.3 DEFINITIONS

A. Activation Device: Device that, when actuated, sends electrical signal to automatic door operator to open door.

B. Safety Device: Device that prevents door from opening or closing.

1.4 PERFORMANCE REQUIREMENTS

A. Opening and Closing Forces: Not more than 15 lbf (67 N applied) 1 inch (25 mm) from the latch edge of the door.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators and activation and safety devices.

B. Shop Drawings: Show fabrication and installation details for automatic door operators. Include locations and elevations of entrances showing activation and safety devices.

1. Include plans, elevations, sections, details, and attachments to other work for guide rails.

C. Samples for Initial Selection: For each type of exposed component and door control indicated.

D. Samples for Verification: For exposed components and activation and safety devices with factory-applied color finishes.

E. Qualification Data: For Installer.

F. Field quality-control test reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

H. Operation and Maintenance Data: For automatic door operators to include in emergency, operation, and maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: Company certificate issued by AAADM.

C. Testing Agency Qualifications: An independent agency with inspector certified by AAADM.

D. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

E. 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.

F. UL Standard: Comply with UL 325.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify door openings by field measurements before fabrication of exposed covers for automatic door operators and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared 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.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and security access control system.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Faulty or sporadic operation of automatic door operator or activation and safety devices.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly 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 same as those used in the manufacture and installation of original equipment.

1. Engage inspector certified by AAADM to perform safety inspection after each adjustment or repair and at end of maintenance period. Submit completed inspection form to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

1.11 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. Activation and Safety Devices: One unit of each type.

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. Besam Automated Entrance Systems, Inc.
2. DORMA Architectural Hardware.
3. Dor-O-Matic, Inc.; an Ingersoll-Rand Company.
4. EFCO Corporation.
5. Horton Automatics.
6. KM Systems, Inc.
7. LCN Closers; an Ingersoll-Rand Company.
8. Nabco Entrances Inc.
9. Stanley Access Technologies; Div. of The Stanley Works.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extrusions: ASTM B 221 (ASTM B 221M, Alloy 6063-T5 or T-6).

B. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.3 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 long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

1. Provide door operators that comply with NFPA 80 requirements for doors as emergency exits and that do not interfere with fire ratings.

B. Electromechanical Operating System: Unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with manual operation including spring closing with power off.

C. Housing: Fabricated from 0.125-inch- (3.2-mm-) thick extruded or formed aluminum.

D. Exposed Cover: Fabricated from 0.125-inch- (3.2-mm-) thick extruded aluminum; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

1. Finish: Match door and frame.

2. Color: As selected by Architect from manufacturer's full range.

2.4 LOW-ENERGY, POWER-OPERATING DOOR OPERATORS

A. Standard: Comply with BHMA A156.19.

B. Performance Requirements:

1. Not more than 15 lbf (67 N applied) 1 inch (25 mm) from latch edge of door to prevent stopped door from opening or closing.
2. If power fails, not more than 30 lbf (133 N applied) 1 inch (25 mm) from latch edge of door to manually set door in motion.

C. Operation: Power opening and power-assisted spring closing.

1. Power-Assisted Opening: Power-assisted opening that reduces force to open self-closing door. Pushing or pulling on door activates automatic door operator.

D. Operating System: Electromechanical.

E. Microprocessor Control Unit: Solid-state controls.

F. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening force.
3. Adjustable backcheck.
4. Adjustable hold-open time of not less than 0 to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.

G. Mounting: Surface.

2.5 ACTIVATION AND SAFETY DEVICES

A. Wall Push-Plate Switch: Manufacturer's standard semiflush, wall-mounted, door control switch; consisting of round or square, flat push plate; of material indicated; and actuator mounted in recessed junction box. Provide engraved message as indicated.

1. Material: Stainless steel.
2. Message: International symbol of accessibility and "Push to Open."

B. Remote Switch: Manufacturer's standard surface-mounted, door control switch; consisting of rectangular, flat push plate; of material indicated; and actuator mounted in junction box. Provide engraved message as indicated.

1. Material: Stainless steel.

2. Message: International symbol of accessibility and "Push to Open."
3. Mounting: Post.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 ACCESSORIES

A. Low-Energy Automatic Door Operator Signage: Comply with BHMA A156.19.

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. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of automatic door operators.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install complete automatic door operator system, including activation and safety devices, control wiring, and remote power units.

B. Low-Energy Power Door Operator Installation Standard: Comply with BHMA A156.19 for installation.

C. Activation and Safety Devices: Install devices and wiring, including connections to automatic door operators, according to BHMA A156.10 and as follows:

1. Wall Switches: Provide push plates on both sides of each opening indicated to receive automatic door operators.

2. Provide remote switch on post located on exterior side of entrance door.

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 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. Testing and Inspecting: After installation has been completed, testing and inspecting of each automatic door operator shall be performed to verify compliance with applicable BHMA standards.

1. Inspection Report: Submit report in writing to Architect and Contractor within 24 hours after inspection.

C. Remove and replace automatic door operators where test results indicate they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Adjust automatic door operators and activation and safety devices to operate smoothly, easily, and properly, and for safe operation and weathertight closure.

1. Adjust doors with low-energy door operators to close according to BHMA A156.19.

B. Lubricate operators, hardware, and other moving parts.

C. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes and repair damaged finishes.

D. Readjust automatic door operators and activation and safety devices after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

E. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 08716

SECTION 08800 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed Entrances

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include

edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Specified Design Wind Loads: as indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
   b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

      1) Basic Wind Speed: 90 mph
      2) Importance Factor: II.
      3) Exposure Category: B.

   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

      1) Load Duration: 3 seconds.

   d. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.

   e. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

1. Each color of tinted float glass.
2. Each type of patterned glass.
3. Coated vision glass.
4. Ceramic-coated spandrel glass.
5. Each pattern and color of ceramic-coated vision glass.
6. Wired glass.
7. Fire-resistive glazing products.
8. Each type of laminated glass with colored interlayer.
9. Insulating glass for each designation indicated.
10. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each of the following types of glazing products:

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing gaskets.

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

H. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 257.

I. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

J. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

K. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.
3. Product: Subject to compliance with requirements, provide product specified.
4. 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.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
6. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

A. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.

B. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:

    a. Manufacturer's standard sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

    a. Spacer Material: Aluminum with bronze, color anodic finish.
    b. Desiccant: Molecular sieve or silica gel, or blend of both.
    c. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants GS-1:

a. Available Products:

1) Dow Corning Corporation; 790.
2) GE Silicones; SilPruf LM SCS2700.
3) Pecora Corporation; 864.

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 50.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

1) Use O Glazing Substrates: Coated glass, color anodic aluminum and aluminum coated with a high-performance coating.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.7 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units MG-1: Class 1 (clear) Kind FT (fully tempered) float glass.

1. Thickness: 6.0 mm.

2.8 INSULATING-GLASS UNITS

A. Passive Solar Low-E Insulating-Glass Units IG-1:

1. Basis-of-Design Product: Oldcastle Glass or a comparable product by one of the following:

   a. TC Insulating Glass Inc.
   b. AGC Flat Glass North America

2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
3. Interspace Content: Argon.
4. Outdoor Lite: Class 2 (tinted) float glass complying with ceramic-coated vision-glass requirements.

   a. Tint Color: Bronze.
   b. Annealed.

5. Indoor Lite: Class 1 (clear) float glass.

   a. Annealed.

6. Low-E Coating: Pyrolytic or sputtered on second or third surface.

7. Visible Light Transmittance: 45 percent minimum.
8. Winter Nighttime U-Factor: 0.35 maximum.
9. Summer Daytime U-Factor: 0.38 maximum.
10. Solar Heat Gain Coefficient: 0.61 maximum.
11. Outdoor Visible Reflectance: 10 percent maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

SECTION 08830 - MIRRORS

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 types of silvered flat glass mirrors.

1. Annealed monolithic glass mirrors.

B. Related Sections include the following:

1. Division 10 Section "Toilet and Bath Accessories" for metal-framed mirrors.

1.3 DEFINITIONS

A. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.4 PERFORMANCE REQUIREMENTS

A. Provide mirrors that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
2. Mirror mastic.
3. Mirror hardware.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of mirror product required, in the form indicated below:

1. Mirrors, 12 inches (300 mm) square, including edge treatment on 2 adjoining edges.
2. Mirror clips.
3. Mirror trim, 12 inches (300 mm) long.

D. Product Certificates: For each type of mirror, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed mirror glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirror installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under NGA's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Mirrors: Obtain mirrors from one source for each type of mirror indicated.

C. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mirrors that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide mirrors by one of the following:

1. Arch Aluminum & Glass Co., Inc.
2. Gardner Glass Products.
3. Gilded Mirrors, Inc.
4. Guardian Industries Corp.
5. Independent Mirror Industries, Inc.
6. Lenoir Mirror Company.
7. Messer Industries, Inc.
8. Stroupe Mirror Co., Inc.
9. Sunshine Mirror.
10. Virginia Mirror Company, Inc.
11. VVP America, Inc.; Binswanger Mirror Products.
12. Walker Glass Co., Ltd.

2.2 SILVERED FLAT GLASS MIRROR MATERIALS

A. Clear Glass Mirrors: ASTM C 1503, Mirror Select Quality.

1. Nominal Thickness: 5.0 mm.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

2.4 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.

1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and film backing compatible with mirror backing paint as certified by mirror manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with mirror installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install mirrors with mirror hardware.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
2. Where indicated, install mirror hardware in the form of J-channels that are fabricated in single lengths to fit and cover top and bottom edges of mirrors.

3.3 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 08830

SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

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 non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Division 7 Section "Building Insulation" for insulation installed with Z-shaped furring members.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Products: Subject to compliance with requirements, provide one of the following:

      1) Steel Network Inc. (The); VertiTrack VTD Series.
      2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).

D. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38.1 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
2. Depth: 7/8 inch (22.2 mm).

F. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

G. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09111

SECTION 09250 - GYPSUM BOARD

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. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
3. Division 7 Section "Joint Sealants" for acoustical sealants installed in assemblies that incorporate gypsum board.
4. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
5. Division 9 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Gypsum Co.
   b. BPB America Inc.
   c. G-P Gypsum.

d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Regular Type:

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

C. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

E. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

F. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

2.6 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

1. Texture: Fine.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: As indicated on Drawings.
2. Type X: Unless Noted Otherwise.
3. Ceiling Type: As indicated on Drawings.
4. Abuse-Resistant Type: As indicated on Drawings.
5. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 9 Sections.

5. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.6 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and

overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

D. Qualification Data: For testing agency.

E. Field quality-control test reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

G. Research/Evaluation Reports: For each acoustical panel ceiling and components.

H. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A, B, or C (where indicated) materials as determined by testing identical products per ASTM E 84:

    a. Smoke-Developed Index: 450 or less.

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide USG Eclipse ClimaPlus or a comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Ecophon CertainTeed, Inc.

C. Color: White

D. LR: Not less than 0.86.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. AC: Not less than 180.

H. Edge/Joint Detail: SLT Shadow Line Tapered.

I. Thickness: 3/4 inch.

J. Modular Size: As indicated on Drawings.

K. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

H. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide USG DONN DX/DXL 15/16” or a comparable product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements

for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.
   b. Install panels with pattern running in one direction parallel to long axis of space.
   c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:

1. Suspended ceiling system.
2. Hangers, anchors and fasteners.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09651 - RESILIENT FLOOR TILE

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. Vinyl composition tile (VCT).

B. Related Sections include the following:

1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL COMPOSITION TILE, VCT-1.

A. Vinyl Composition Tile (VCT): ASTM F 1066.

1. AB ColorPlus, American Biltrite (Canada) Ltd.;
2. Armstrong World Industries, Inc.;
3. Azrock Commercial Flooring, DOMCO;

B. Class: 2 (through-pattern tile).

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. VCT and Asphalt Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.
c. Rubber Floor Adhesives: 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

    a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

    1. Do not install resilient products until they are same temperature as space where they are to be installed.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

    1. Lay tiles square with room axis.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

    1. Lay tiles in pattern of colors and sizes indicated.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to manufacturer.
    b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09651

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

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 base.
2. Stair accessories.
3. Molding accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 RESILIENT WALL BASE: “Vinyl Cove Base” or WB-1.

A. Wall Base: ASTM F 1861.

1. AFCO-USA, American Floor Products Company, Inc.
2. Armstrong World Industries, Inc.
3. Azrock Commercial Flooring, DOMCO;
4. Burke Mercer Flooring Products;

B. Type (Material Requirement): TV (vinyl).

C. Group (Manufacturing Method): I (solid, homogeneous) or II (layered).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.080 inch.

F. Height: 4 inches (102 mm).

G. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

H. Outside Corners: Job formed or premolded.

I. Inside Corners: Job formed or premolded.

J. Surface: Smooth.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: 50 g/L.
b. Rubber Floor Adhesives: 60 g/L.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates for Stair Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

   a. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to stair accessory surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to manufacturer.
    b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover stair accessory products with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over stair accessories. Place plywood or hardboard panels over surfaces and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09653

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 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes modular, carpet tile.

B. Related Sections include the following:

1. Division 9 Section “Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 SUBMITTALS

A. Product Data: For each type of 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. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet tile type, color, and dye lot.
5. Type of subfloor.
6. Type of installation.
7. Pattern of installation.
8. Pattern type, location, and direction.
9. Pile direction.
10. Type, color, and location of insets and borders.
11. Type, color, and location of edge, transition, and other accessory strips.
12. Transition details to other flooring materials.

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 and in schedules.

1. Carpet Tile: Full-size Sample.

2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) 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 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. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet tile installation including, but not limited to, the following:

1. Review delivery, storage, and handling procedures.
2. Review ambient conditions and ventilation procedures.

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. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

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. (8.3 sq. m).

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:

1. Shaw; Philadelphia, High Voltage Commercial Carpet Tile.

a. Color: As selected by Architect from manufacturer's full range.
b. Pattern: As selected by Architect from manufacturer's full range.

B. Fiber Content: 100 percent nylon 6.

C. Fiber Type: 69% eco solution Q Nylon – 31% space dyed Nylon.

D. Pile Characteristic: Graphic-loop pile.

E. Density: 8075 oz./cu. yd.

F. Pile Thickness: 0.107” for finished carpet tile per ASTM D 6859.

G. Stitches: 11 stitches per inch.

H. Gage: 1/10 gage in ends per inch.

I. Surface Pile Weight: 24 oz./sq. yd.

J. Total Weight: 101 oz./sq. yd. for finished carpet tile.

K. Primary Backing/Backcoating: Manufacturer's standard composite materials.

L. Secondary Backing: Manufacturer's standard material.

M. Size: 24 by 24 inches.

N. Applied Soil-Resistance Treatment: Manufacturer's standard material.

O. Antimicrobial Treatment: Manufacturer's standard material.

P. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
3. Tuft Bind: Not less than 3 lbf (13 N) per ASTM D 1335.
4. Delamination: Not less than 3.5 lbf/in. (15 N/mm) per ASTM D 3936.
5. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
6. Dimensional Stability: 0.2 percent or less per ISO 2551 (Aachen Test).
7. Resistance to Insects: Comply with AATCC 24.
8. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
9. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
10. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
11. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
12. VOC Limits: Provide carpet tile that complies with the following limits for VOC content when tested according to ASTM D 5116:

    a. Total VOCs: 0.5 mg/sq. m x h.
    b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
    c. Formaldehyde: 0.05 mg/sq. m x h.
    d. Styrene: 0.4 mg/sq. m x h.

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.

1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

a. Total VOCs: 10.00 mg/sq. m x h.
b. Formaldehyde: 0.05 mg/sq. m x h.
c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

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 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For metal subfloors, verify the following:

1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. For painted subfloors, verify the following:

1. Perform bond test recommended in writing by adhesive manufacturer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: 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 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by 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. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. 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: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in 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. Bind or seal cut edges as recommended by carpet tile manufacturer.

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 nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

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 09681

SECTION 09911 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.

B. Related Sections include the following:

1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 8 Sections for factory priming windows and doors with primers specified in this Section.
3. Division 9 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

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 "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.

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 (7 deg C).

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 (10 and 35 deg C).

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. (3.8 L) 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. Benjamin Moore & Co.

2. Bennette Paint Mfg. Co., Inc.
3. BLP Mobile Paint Manufacturing.
4. California Paints.
5. ChemRex.
6. Cloverdale Paint.
7. Color Wheel Paints & Coatings.
8. Columbia Paint & Coatings.
9. Coronado Paint.
10. Davis Paint Company.
11. Del Technical Coatings.
12. Diamond Vogel Paints.
13. Dunn-Edwards Corporation.
14. Durant Paints Inc.
15. Duron, Inc.
16. Envirocoat Technologies Inc.
17. Farrell-Calhoun.
18. Flex Bon Paints.
19. Frazee Paint.
20. General Paint.
21. Griggs Paint.
22. Hallman Lindsay Quality Paints.
23. Hirshfield's, Inc.
24. ICI Devoe (Canada).
25. ICI Paints.
26. ICI Paints (Canada).
27. Insl-x.
28. Iowa Paint Manufacturing Company, Inc.
29. Kelly-Moore Paints.
30. Kryton Canada Corporation.
31. Kwal-Howells Paint.
32. M.A.B. Paints.
33. McCormick Paints.
34. Miller Paint.
35. Mills Paint.
36. NCP Coatings.
37. Northern Paint.
38. PARA Paints.
39. Parker Paint Mfg. Co. Inc.
40. Porter Paints.
41. PPG Architectural Finishes, Inc.
42. Rodda Paint Co.
43. Sherwin-Williams Company (The).
44. Sico, Inc.
45. Sigma Coatings.
46. Smiland Paint Company.
47. Spectra-Tone.
48. Tamms Industries, Inc.
49. Tower Paint.
50. Vista Paint.

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.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

2.4 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).

1. VOC Content: E Range of E1.

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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. 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.

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.

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. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. 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 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Alkyd System: MPI EXT 5.1D.

   a. Prime Coat: Alkyd anticorrosive metal primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel (flat).

B. Galvanized-Metal Substrates:

1. Alkyd System: MPI EXT 5.3B.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    c. Topcoat: Exterior alkyd enamel (flat).

END OF SECTION 09911

SECTION 09912 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Steel.
3. Galvanized metal.
4. Aluminum (not anodized or otherwise coated).
5. Gypsum board.

B. Related Sections include the following:

1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 8 Sections for factory priming windows and doors with primers specified in this Section.
3. Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
4. Division 9 painting Sections for special-use coatings.

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 in 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 "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.

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 (7 deg C).

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 (10 and 35 deg C).

B. Do not apply paints 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. (3.8 L) 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Bennette Paint Mfg. Co., Inc.
3. BLP Mobile Paint Manufacturing.
4. California Paints.
5. ChemRex.
6. Cloverdale Paint.
7. Color Wheel Paints & Coatings.
8. Columbia Paint & Coatings.
9. Coronado Paint.
10. Davis Paint Company.
11. Diamond Vogel Paints.
12. Dunn-Edwards Corporation.
13. Durant Paints Inc.
14. Duron, Inc.
15. Envirocoat Technologies Inc.
16. Farrell-Calhoun.
17. Flex Bon Paints.
18. Frazee Paint.
19. General Paint.
20. Griggs Paint.
21. Hallman Lindsay Quality Paints.
22. Hirshfield's, Inc.
23. ICI Devoe (Canada).
24. ICI Paints.
25. ICI Paints (Canada).
26. Insl-x.
27. Iowa Paint Manufacturing Company, Inc.
28. Kelly-Moore Paints.
29. Kryton Canada Corporation.
30. Kwal-Howells Paint.
31. M.A.B. Paints.
32. McCormick Paints.
33. Miller Paint.
34. Mills Paint.
35. Northern Paint.
36. PARA Paints.
37. Parker Paint Mfg. Co. Inc.
38. Porter Paints.
39. PPG Architectural Finishes, Inc.
40. Rodda Paint Co.
41. Sherwin-Williams Company (The).
42. Sico, Inc.
43. Sigma Coatings.
44. Smiland Paint Company.
45. Spectra-Tone.
46. Sterling Paint.
47. Tamms Industries, Inc.
48. Tower Paint.

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. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

B. Interior Alkyd Primer/Sealer: MPI #45.

1. VOC Content: E Range of E2.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E2.

B. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

2.5 LATEX PAINTS

A. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 5.

2.6 ALKYD PAINTS

A. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

1. VOC Content: E Range of E2.

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. 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 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. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

F. 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.

G. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

H. 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.

I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

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 equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

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: 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.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

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. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. 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. CMU Substrates:

1. Latex System: MPI INT 4.2A.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (eggshell).

B. Steel Substrates:

1. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (eggshell).

C. Galvanized-Metal Substrates:

1. Alkyd System: MPI INT 5.3C.

a. Prime Coat: Cementitious galvanized-metal primer.

b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (eggshell).

D. Gypsum Board Substrates:

1. High-Performance Architectural Latex System: MPI INT 9.2B.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex (eggshell).

END OF SECTION 09912

SECTION 09931 - WOOD STAINS AND TRANSPARENT FINISHES

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 surface preparation and the application of wood finishes on the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry).
b. Exposed wood panel products.

B. Related Sections include the following:

1. Division 9 Section "Interior Painting" for surface preparation and application of standard paint systems on interior substrates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
2. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.

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 (7 deg C).

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 finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply exterior finishes 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. (3.8 L) 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. Benjamin Moore & Co.
2. Benjamin Moore & Co., Limited (Canada).
3. Bennette Paint Mfg. Co., Inc.
4. BLP Mobile Paint Manufacturing.
5. Cabot Incorporated, Samuel.

6. California Paints.
7. Cloverdale Paint.
8. Color Wheel Paints & Coatings.
9. Columbia Paint & Coatings.
10. Coronado Paint.
11. Diamond Vogel Paints.
12. Dunn-Edwards Corporation.
13. Durant Paints Inc.
14. Duron, Inc.
15. Endura.
16. Farrell-Calhoun.
17. Flex Bon Paints.
18. Frazee Paint.
19. General Paint.
20. Griggs Paint.
21. Hallman Lindsay Quality Paints.
22. Hirshfield's, Inc.
23. ICI Devoe (Canada).
24. ICI Paints.
25. ICI Paints (Canada).
26. Insl-x.
27. Iowa Paint Manufacturing Company, Inc.
28. Kelly-Moore Paints.
29. Kryton Canada Corporation.
30. Kwal-Howells Paint.
31. M.A.B. Paints.
32. McCormick Paints.
33. Miller Paint.
34. Mills Paint.
35. Northern Paint.
36. PARA Paints.
37. Parker Paint Mfg. Co. Inc.
38. Porter Paints.
39. PPG Architectural Finishes, Inc.
40. Rodda Paint Co.
41. Sherwin-Williams Company (The)
42. Sico, Inc.
43. Sigma Coatings.
44. Spectra-Tone.
45. Tamms Industries, Inc.
46. Tower Paint.
47. Vista Paint.

2.2 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each finish 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 finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

B. Stain Colors: As selected by Architect from manufacturer's full range.

2.3 STAINS

A. Interior Wood Stain (Semitransparent): MPI #90.

1. VOC Content: E Range of E1.

2.4 POLYURETHANE FINISHES

A. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.

1. VOC Content: E Range of E1.

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.

1. Maximum Moisture Content of Wood Substrates: 15 percent when measured with an electronic moisture meter.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.
3. Begin finish application only after unsatisfactory conditions have been corrected and surfaces are dry.
4. Beginning application of finish system constitutes Contractor's acceptance of substrate and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
3. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.

D. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when finishes are being applied:

1. Owner will engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes 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 finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.6 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Finish Carpentry Substrates:

1. Polyurethane Varnish Over Stain System: MPI INT 6.3E.

a. Stain Coat: Interior wood stain (semitransparent).
b. Two Finish Coats: Interior, oil-modified, clear urethane (satin).

B. Exposed Wood Panel-Product Substrates:

1. Polyurethane Varnish Over Stain System: MPI INT 6.4E.

a. Stain Coat: Interior wood stain (semitransparent).
b. Two Finish Coats: Interior, oil-modified, clear urethane (satin).

END OF SECTION 09931

SECTION 10155 - TOILET COMPARTMENTS

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 baked-enamel units as follows:

1. Toilet Enclosures: Overhead braced.
2. Urinal Screens: Wall hung.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Carpentry" for blocking.
2. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

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. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.

C. Samples for Initial Selection: For each type of unit indicated.

D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

1.4 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments 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 toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 METAL UNITS

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. Accurate Partitions Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Hadrian Inc.
10. Knickerbocker Partitions Corp.
11. Lambaton Universal.
12. Metpar Corp.
13. Sanymetal; a Crane Plumbing Company.
14. Weis-Robart Partitions, Inc.

B. Baked-Enamel Units: Facing sheets and closures fabricated from ASTM A 591/A 591M, 80Z (24G) (electrolytically zinc-coated) or ASTM A 653/A 653M (hot-dip galvanized or galvannealed), commercial steel sheet for exposed applications, that is mill phosphatized, and selected for smoothness.

1. Facing Sheet Thicknesses: Minimum base-metal (uncoated) thicknesses as follows:

a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.0329 inch (0.85 mm).
b. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.0438 inch (1.1 mm).
c. Panels: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).
d. Doors: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).
e. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0269 inch (0.7 mm).

2. Finish: Manufacturer's standard pigmented, organic coating, including thermosetting, electrostatically applied, and powder coatings. Provide coating system that complies with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.

   a. Color: One color in each room as selected by Architect from manufacturer's full range of colors.

C. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets are pressure laminated to core material. Units have continuous, interlocking molding strip or lapped and formed edge closures. Exposed surfaces are free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections. Corners are sealed by welding or clips. Exposed welds are ground smooth.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
4. Urinal-Screen Construction: Similar to panels, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.

D. Pilaster Shoes: Stainless steel, ASTM A 666, Type 302 or 304, not less than 0.0312 inch (0.8 mm) specified thickness and 3 inches (75 mm) high, finished to match hardware.

E. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

2.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be accessible to people with disabilities.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

   a. Pilasters and Panels: 1/2 inch (13 mm).
   b. Panels and Walls: 1 inch (25 mm).

2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than three brackets attached at midpoint and near top and bottom of panel.

   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10155

SECTION 10431 - SIGNS

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. Panel signs.
2. Dimensional characters (letters and numbers) and logos.
3. Signage accessories.

B. Related Sections include the following:

1. Division 10 Section "Post and Panel Signs" for freestanding exterior aluminum panel signs, including accessible parking signs.
2. Division 14 Section "Electric Traction Elevators" for code-required elevator signage.
3. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
4. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
5. Division 16 Section "Interior Lighting" for illuminated exit signs.
6. See Division 16 Sections for electrical service and connections for illuminated characters and for access to remote transformers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
2. Wiring Diagrams: For signs with illuminated characters.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Approved samples will be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Illuminated Exit Signs: Refer to Division 16. ADA
b. Fire Doors: NFPA
c. Elevator Signs: ADA
d. Stairway Identification: NFPA
e. Signs for Accessible Spaces: ADA

D. 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.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

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 manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
3. Basis-of-Design Product: The design for each sign is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.

B. Available Manufacturers:

1. Allenite Signs; Allen Marking Products, Inc.
2. American Graphics Inc.
3. Andco Industries Corp.
4. APCO Graphics, Inc.
5. ASI Sign Systems, Inc.
6. Best Manufacturing Co.
7. Grimco, Inc.
8. Innerface Sign Systems, Inc.
9. Kaltech Industries Group, Inc.
10. Mills Manufacturing, Inc.
11. Mohawk Sign Systems.
12. Seton Identification Products.
13. Signature Signs, Inc.
14. Supersine Company (The).
15. Hagar Companies

C. PVC: Extruded, high-impact PVC plastic in color as selected by Architect.

D. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition: Square cut.
2. Corner Condition: Square.

E. Graphic Content and Style: Provide sign copy that complies with requirements indicated [**in the Sign Schedule**] [**on Drawings**] [**on artwork supplied on electronic media by Architect**] for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

F. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2.3 DIMENSIONAL CHARACTERS

A. Available Manufacturers:

1. American Graphics Inc.
2. A.R.K. Ramos.
3. ASI Sign Systems, Inc.
4. Charleston Industries, Inc.
5. Gemini Incorporated.
6. Grimco, Inc.
7. Innerface Sign Systems, Inc.
8. Kaltech Industries Group, Inc.
9. Metal Arts; Div. of L&H Mfg.
10. Mills Manufacturing, Inc.
11. Mohawk Sign Systems.
12. Signature Sign Signs, Inc.
13. Southwell Co. (The).

B. Cutout Characters: Cut characters from solid plate of thickness and metal indicated. Produce precisely cut characters with square cut, smooth**,** eased edges. Comply with requirements indicated for finish, style, and size.

1. Bronze Plate: Not less than 3/16 inch thick.
2. Character Height: 6 inches on East Elev / 12 inches on North Elev.
3. Character Style: Times New Roman.

2.4 PANEL SIGN TYPES

A. Room Signs:

1. Material: Plastic.

2. Perimeter: Unframed.
3. Copy: Tactile and braille.
4. Character Style: Times New Roman.
5. Text: Name of room as indicated on drawings.
6. Message: Fixed.
7. Sizes:

    a. Sign: As required for content.
    b. Character: Minimum ½" high characters.

8. Colors:
    a. Character: As selected by architect.
    b. Background: As selected by architect.

B. Toilet Room Signs:

1. Material: Plastic.
2. Perimeter: Unframed.
3. Copy: Raised.
4. Character Style: Manufacturer's Standard
5. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
6. Message: Fixed.
7. Sizes:

    a. Sign: 6" x 8"
    b. Character: Minimum 1-inch- (25-mm-) high characters.

8. Colors:
    a. Character: White
    b. Background: Black

C. Accessible Parking Signs:

1. Material: 0.080-inch (2-mm) aluminum or other noncorrosive material.
2. Background Color: Blue.
3. Copy Material: Reflective vinyl.
4. Mounting: Flush mounted to building with fasteners to suit building substrate, or on posts as indicated on civil drawings.

D. Symbols of Accessibility: Provide 6-inch- (150-mm-) high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch (0.089-mm) nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.5 ACCESSORIES

A. Vinyl Film: Provide opaque reflective vinyl film, 0.0035-inch (0.089-mm) minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

B. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

C. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. Note Holders: Manufacturer's standard aluminum paper sheet holders.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, and electrical power provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent

walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

C. Bracket-Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

D. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface (TBD).

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10431

SECTION 10801 - TOILET AND BATH ACCESSORIES

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. Public-use washroom accessories.
2. Underlavatory guards.

B. Related Sections include the following:

1. Division 8 Section "Mirrors" for frameless mirrors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. 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.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

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:

C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

D. Toilet Tissue (Roll) Dispenser TA-01:

1. Furnished by owner.

E. Grab Bar TA-02:

1. Basis-of-Design Product: Boberick B-5806
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

   a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Configuration and Length: As indicated on Drawings.

F. Mirror Unit TA-03:

1. Frame: Stainless-steel channel.

   a. Corners: Manufacturer's standard.

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

   a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

3. Size: As indicated on drawings, (min 24”x48”).

G. Liquid-Soap Dispenser TA-05:

1. Basis-of-Design Product: Boberick B-5050
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 50-fl oz.
5. Materials: Valve, constructed from high-impact grey ABS with high gloss finish.
6. Lockset: Vandal-resistant, concealed.
7. Refill Indicator: Window type.

H. Combination Towel (Roll) Dispenser/Waste Receptacle TA-06:

1. Basis-of-Design Product: Boberick B-3974
2. Description: Automatic Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
3. Mounting: Semirecessed.
4. Minimum Towel-Dispenser Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
5. Minimum Waste Receptacle Capacity: 12 gal. (45.4 L).
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel dispenser compartment.

I. Recessed Napkin / Tampon Vender TA-07

1. Basis of Design Product: Boberick B-352 25.

J. Surface Mounted Sanitary Napkin Disposal TA-08

1. Basis of Design Product: Boberick B-270.

K. Surface Mounted Automatic Towel (Roll) Dispenser TA-09

1. Basis of Design Product: San Jamar “Black Pearl” T1400TBK.

2.3 UNDERLAVATORY GUARDS

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. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

C. Underlavatory Guard TA-04:

1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 11451 - RESIDENTIAL APPLIANCES

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. Cooking equipment including:
   a. Microwave ovens.
2. Refrigerator/freezers.

B. Owner-Furnished Material: Ice Makers, Coffee and Vending Machines.

C. Related Sections include the following:

1. Division 6 Section "Interior Architectural Woodwork" for custom-made cabinets and plastic-laminate tops that receive residential appliances.
2. Division 12 Section "Kitchen Casework" for standard cabinets and countertops that receive residential appliances.
3. Division 15 Section "Domestic Water Piping" for water distribution piping connections to residential appliances.
4. Division 15 Section "Sanitary Waste and Vent Piping" for drainage and vent piping connections to residential appliances.
5. Division 15 Section "Plumbing Fixtures" for kitchen sinks, waste disposers, and instant hot-water dispensers.
6. Division 16 Section "Conductors and Cables" for services and connections to residential appliances.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

B. Appliance Schedule: For appliances; use same designations indicated on Drawings.

C. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each product.

E. Maintenance Data: For each product to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 75 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Product Options: Information on Drawings and in Specifications establishes requirements for product's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

D. Regulatory Requirements: Comply with provisions of the following product certifications:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
4. NAECA: Provide residential appliances that comply with NAECA standards.

E. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Operable Parts: Provide controls with forward reach no higher than 48 inches (1219 mm) above the floor, horizontal front reach no more than 25 inches (635 mm), horizontal side reach no more than 24 inches (610 mm), and that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Refrigerator/Freezer: Provide 50 percent of freezer space within 54 inches (1370 mm) of the floor.

F. AHAM Standards: Provide appliances that comply with the following AHAM standards:

1. Household Refrigerators: AHAM HRF-1.
2. Household Freezers: AHAM HRF-1.

G. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Microwave Oven: Five-year limited warranty for in-home service on defects in the magnetron tube.
2. Refrigerator/Freezer: Five-year limited warranty for in-home service on the sealed refrigeration system.
3. Freezer: Five-year limited warranty for in-home service on the sealed refrigeration system.

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. Basis-of-Design Product: The design for each residential appliance is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 COOKING APPLIANCES

A. Microwave Oven MO-1:

1. Basis-of-Design Product: Whirlpool GT4175SPS or a comparable product by one of the following:

a. General Electric Company
b. Maytag
c. KitchenAid

2. Oven(s): Standard features include the following:

a. Oven Capacity: 1.7 cu. ft..
b. Oven Features: Digital control panel with timer display and turntable.
c. Mounting: Countertop Model.

d. Electrical Power: 1200 W.
e. Oven Door: Counter-balanced, removable, with observation window.
f. Exhaust Fan: nonvented, recirculating-type with charcoal filter.

2.3 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer RF-1:

1. Basis-of-Design Product: Whirlpool W9RXXMFWQ or a comparable product by one of the following:

   a. General Electric Company
   b. Maytag
   c. KitchenAid

2. Type: Freestanding, auto-defrost, with freezer on top.
3. Storage Capacity:

   a. Fresh Food Compartment Volume: 13.9 cu. ft.
   b. Freezer Volume: 5.0 cu. ft.
   c. Shelf Area: 4 adjustable wire shelves, 26 sq. ft. (2.42 sq. m.).

4. Refrigerator Features:

   a. Compartment Storage: Humidity crisper and Meat pan.
   b. Door Storage: Modular compartments.
   c. Interior light in compartment.

5. Freezer Features:

   a. Ice storage bins.
   b. Automatic icemaker and storage bin.
   c. Circulator fan.

6. Energy Consumption: Measured and certified by AHAM HRF-1 at not more than 688 kWh/year under average conditions for a refrigerated volume of 18.9 cu. ft..
7. Temperature Controls: Separate temperature controls for each compartment.
8. Front Panel: Manufacturer's standard.

   a. Panel Color: White.

9. Appliance Color: White.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Color-Coated Finish: Provide appliances with manufacturer's standard finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, color, gloss, and minimum dry film thickness for painted finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.3 CLEANING AND PROTECTION

A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 11451

SECTION 14210 – ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:
1. Hoist Beam
2. Pit Ladder

C. Work Supplied Under Other Sections:
1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Hoistway ventilation shall be in accordance with local and national building code requirements.
3. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
4. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
5. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
6. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
7. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
8. Access Doors: As required for access to governor. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

D. Related sections:

1. Section 03300 - Cast-in-Place Concrete:
2. Section 04810 - Unit Masonry
3. Section 05500 - Metal Fabrications

4. Section 230000 - Heating, Ventilating, and Air Conditioning
5. Section 16100 - Electrical

E. Industry and government standards:
1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities

3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.02 DESCRIPTION OF ELEVATOR

A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator

B. Equipment Control: KCM831

C. Quantity of Elevators: 1

D. Landings: 2

E. Openings: 2 Front Openings, 0 Back Openings

F. Travel: 12'-0"

G. Rated Capacity: 2500 lbs (1134 kg)

H. Rated Speed: 150 fpm

I. Clear Inside Dimensions (W x D): 6'-8" x 4'-3"

J. Cab Height: 8'

K. Clear height under suspended ceiling: 7'-7"

L. Entrance Width & Type: 3'-6" & Left Opening

M. Entrance Height: 7'

N. Main Power Supply: 208 Volts + 5%, three-phase

O. Operation: Simplex

P. Machine Location: Inside the hoistway mounted on car guide rail

Q. Control Space Location: Remote Closet

R. Elevator Equipment shall conform to the requirements of seismic zone: Non-Seismic

S. Maintenance Service Period: 12 Months

1.03 PERFORMANCE REQUIREMENTS

A. Car Performance

1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance
1. Vertical Vibration (maximum): 25 mg
2. Horizontal Vibration (maximum): 25 mg
3. Jerk Rate (maximum): 1.3 ft/sec3
4. Acceleration (maximum) 1.3 ft/sec2
5. In Car Noise: = 55 dB(A)
6. Leveling Accuracy: ±0.2 inches
7. Starts per hour (maximum): 120

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product literature for each proposed system.
1. Cab design, dimensions and layout.
2. Layout, finishes, and accessories and available options.
3. Controls, signals and operating system.
4. Color selection charts for cab and entrances.

B. Shop Drawings:
1. Clearances and travel of car.
2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

C. Operation and maintenance data:
1. Provide manufacturer's standard maintenance and operation manual.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum of ten years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

B. Installer: The equipment manufacturer shall install the elevator.

C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.06 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional lablor costs for double handling will be the responsibility of the general contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.07 WARRANTY

A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.08 MAINTENANCE SERVICE

A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 Months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

B. Maintenance service be performed during regular working hours of regular working days and shall include regular time call back service.

C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
   1. Basis of Design: EcoSpace™ traction elevators by KONE, Inc. (www.kone.com).
   2. Other acceptable machine room-less products:
      a. Otis Elevator Co. - Gen2™ Product
      b. Schindler Elevator Corp. - 400A Product

2.02 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microcomputer based control system to perform all of the functions.
   1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
   2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High

voltage motor power conductors shall be routed and physically segregated from the rest of the controller.

3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Within 100'-0" (30.48m) Controller(s) shall be located in a remote cabinet or room within 140"-0" (42.6 m) wire feet of the elevator machine.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer.

D. Hoistway Operating Devices:
1. Emergency stop switch in the pit
2. Terminal stopping switches.
3. Emergency stop switch on the machine

E. Positioning System: System consisting of magnets and proximity switches.

F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway Entrances
1. Sills: extruded.
2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

B. Platform: Platform shall be all steel construction.

C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab
   1. Car Wall Finish: Brushed stainless steel.
   2. Car Front Finish: Brushed stainless steel.
   3. Car Door Finish: Brushed stainless steel.
   4. Ceiling:
      a. Standard Translucent Panels - LF-1: Polygal Translucent three panel suspended ceiling with T-5 Fluorescent lighting and Brushed Aluminum frame.
   5. Handrail:
      a. Round tube brushed aluminum - 1.5 in.. Rails to be located on Back Wall - Front opening only of car enclosure.

   6. Flooring: By others. (Not to exceed 2sqft & 1/2" finished depth.)
   7. Threshold: Aluminum

E. Emergency Car Signals
   1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
   2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
   3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

F. Ventilation: Fan.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.
   1. Full height car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have amber illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be amber 7 Segment. All texts, when illuminated, shall be amber. The full height car operating panel shall have a polycarbonate face plate that is shatterproof and impact resistant in a color and pattern per manufacturers standard selection.
   2. Additional features of car operating panel shall include:
      a. Car Position Indicator within operating panel (amber).
      b. Elevator Data Plate marked with elevator capacity and car number on car top.
      c. Help buttons with raised markings.
      d. In car stop switch per local code.
      e. Firefighter's hat.

f. Firefighter's Phase II Key-switch.
g. Call Cancel Button.
h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
j. Firefighter's Phase II emergency in-car operating instructions.

B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a polycarbonate face plate that is shatterproof and impact resistant in a color per manufacturers standard selection.
1. Hall fixtures shall feature round, mechanical, illuminated buttons in raised fixture housings. Hall fixtures shall correspond to options available from that landing. Buttons shall be flat flush in vertically mounted fixture. Hall fixtures should not be jamb-mounted. Hall lanterns shall feature amber illumination.

C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

D. Combination Hall Position Indicator and Hall Lantern located at Lobby. Hall laterns and hall indicators shall feature amber illumination, all numbers will be amber display.

2.07 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation
1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
2. Zoned Car Parking.
3. Relative System Response Dispatching.

B. Standard Operating Features to include:
1. Full Collective Operation
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.

C. Additional Operating Features to include:
1. Hoistway Access Bottom Landing
2. Hoistway Access Top Landing
3. Emergency Battery Power Supply

When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

D. Elevator Control System for Inspections and Emergency
   1. Provide devices within controller to run the elevator in inspection operation.
   2. Provide devices on car top to run the elevator in inspection operation.
   3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
   4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
   5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
   6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
   7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain

open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Do not proceed with work until unsatisfactory conditions are corrected.

C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of Work, verify projections greater then 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less then 75 degrees from horizontal.

E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

3.04 CONSTRUCTION

A. Interface with Other Work:
   1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
   2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
      a. Ensure adequate support for entrance attachment points at all landings.
      b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
      c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
      d. Coordinate interface of elevators and fire alarm system.
      e. Coordinate interface of dedicated telephone line.

3.05 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction.

B. Obtain required permits and provide originals to Owner's Representative.

3.06 DEMONSTRATION

A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION

DIVISION 15000
SECTION 15100
PLUMBING

PART I - GENERAL

1.01 Related Documents

A. Provisions of the General Requirements, Division 1, are a part of this section.

1.02 Work Included

A. Piping
   1. Sanitary waste and vent
   2. Hot and cold water

B. Plumbing fixtures and trim.

C. Drawings of Record.

D. Prior to bidding, all Contractors shall visit the site and become familiar with all existing conditions, which will affect construction procedures and scope of work required as part of this Section.

1.03 Related Work

A. Painting by Painting Contractor

B. Cutting and patching

C. Excavation and backfill

1.04 Codes and Standards

A. International Plumbing Code.

B. National Fire Protection Association.

C. American Society of Mechanical Engineers.

D. International Approval Service.

E. American Society for Testing and Materials.

F. American Society of Heating, Refrigerating, and Air Conditioning Engineers.

G. Building Officials and Code Administrators International, Inc.

1.05 Shop Drawings

A. Shop drawings shall be submitted to the Architect for approval. The Contractor shall be responsible for quantities and dimensions. The Contractor shall check all shop drawings prior to submission to the Architect.

PART II - PRODUCTS

2.01 Piping Materials

A. All sanitary waste piping and vent piping shall be Schedule 40 PVC plastic pipe and fittings, except waste piping outside building shall be SDR-35.

B. All hot and cold water piping above grade shall be Type L, hard copper. Below grade shall be type K copper, ASTM B 88, wrought copper fittings, bridgit, lead-free solder.

2.02 Hangers

A. All hangers 1/2" through 6", Elcen Figure 89 or 389, galvanized steel or copper plated steel, all thread rod with concrete insert, lag screw, or other approved anchorage means.

2.03 Valves

A. Ball valves (all valves unless noted on Drawings) shall be Watts 6000 Series ball valves, 2 piece bronze, or equal by Nibco or Crane.

B. All bathroom groups shall have isolation valves on both the cold and hot water supplies. Locate valves as required. If valves are installed within a wall, provide an access door as required. (See Section 15100-3.07)

2.04 Pipe Insulation

A. Shall be 1/2" thick Imcolock. Insulate all above grade hot water and cold water piping.

2.05 Plumbing Fixtures

A. All fixtures shall be of one manufacturer unless specified. See drawings.

B. Vitreous china fixtures shall be twice fired, all exposed surfaces covered with opaque glaze. Cast iron fixtures shall be finished inside with acid resisting porcelain enamel. All exposed trim shall be heavy polished chrome plated brass. Determine quantity of fixtures and equipment from drawings.

2.06 Cleanouts

A. Approved equal by Zurn or Wade. Install maximum of 50 feet on centers, at base of all stacks, and at all 90° bends in waste piping. Cover for cleanouts shall be coordinated with wall and floor finish.

2.07 ADA Compliant Lavatory Insulation

A. All exposed piping under handicap or wheelchair accessible lavatories shall be insulated/isolated with molded, recessed tamper proof security set screws, antimicrobial UV inhibited, universal fit, Handy-Shield Safety Covers Pro-2000 series brand by Plumberex Specialty Products, Inc. or other approved as equal.

2.08 Other Equipment

A. All other equipment (Water Heaters, etc.) shall be as scheduled on drawings.

2.09 Substitutions

A. All substitutions must be pre-approved by the architect prior to bidding. See Division 1 for substitution process.

PART III - EXECUTION

3.01 Installation Instructions.

A. All material and equipment shall be installed as recommended by manufacturer. These specifications shall not be construed to vary from manufacturer's written installation instructions without written approval from manufacturer.

B. It shall be the responsibility of this Contractor to visit the site & coordinate with the other trades for clearance, elevations, etc., before installation of any material. Where conflicts exist the Architect shall be notified before installing material.

Changes required in work specified in this Section caused by neglect to do so shall be made at no cost to the Owner.

C. Arrange with Contractors of other trades for installation of built-in items, blocking, and additional necessary supports.

3.02 Pipe Routing

A. All piping shall be concealed except where approved by Architect.

B. All piping shall be run parallel and/or perpendicular to building lines and shall be neatly grouped. Piping shall be on warm side of insulation.

C. See Drawings for general routing of pipes and see details of drawings for specific pipe routing.

D. Join all copper piping with Bridgit Lead-Free solder and non-corrosive flux Nodorode, or equal clean surfaces to be solder bright.

E. Provide a union or flange connection at each piece of equipment such as water heaters, accessible fixtures etc. so the equipment can be removed or serviced without disturbing remainder of system, draining system or cutting piping.

F. Make all connections between copper and ferrous pipe in domestic water and other open type systems with dielectric unions.

3.03 Plumbing Fixture Installation

A. Provide all fixtures and equipment with compression stops in addition to the faucets.

B. Provide all grounds and supports for the fixtures and other equipment. Arrange with contractors of other trades for installation of built-in items, blocking, and additional necessary supports.

C. Grout behind all wall hung plumbing fixtures with hard white durable plaster materials to eliminate all voids and cracks and provide sufficient plane bearing surface for mounting.

D. Caulk behind all standard wall hung fixtures with G.E. "Silicone Sanitary Sealant" or other approved mildew resistant, paintable, non-hardening sealant.

3.04 Pipe Support Installation

A. Vertical pipe of the following materials shall be supported at intervals not more than the distance prescribed in the following:

1. Copper Tube: At each story, but not more than ten (10) foot intervals.
2. Plastic Pipe: At each story, and at midpoint between floors.
3. Threaded Pipe: At each story, but not more than (10) foot intervals.
4. Cast Iron: At each story, but not more than (15) foot intervals.

B. Horizontal pipe of the following materials shall be supported at intervals not more than the distances prescribed in the following:

1. Copper Tube (1¼ inch or less): At six (6) foot intervals.
2. Copper Tube (1½ inch and over): At ten (10) foot intervals.
3. Plastic Pipe (3 inch or less): At four (4) foot intervals.
4. Plastic Pipe (4 inches and over): At five (5) foot intervals.
5. Threaded Pipe: At twelve (12) foot intervals.
6. Cast Iron: At five (5) foot intervals.

C. Piping shall be so anchored as to take the load off the stack at the base.

D. Hangers and strapping material shall be of similar materials as the piping to avoid galvanic action.

E. Provide additional hangers at each turn and where concentrated loads such as valves, risers, etc. occur.

F. Trapeze Hangers shall not be permitted.

G. Provide pipe covering protection saddles.

H. Construct rigid structural steel anchors to secure piping to building construction where required to stabilize piping.

I. Furnish and install all supplementary steel angles, channels, beams, etc.; where hanger location falls between joists, purlins or beams; for hanging loads exceeding capacity of a single joist, etc. Safety factor of all such assemblies shall be 5 to 1 minimum.

J. Support all piping and equipment from building construction with adequate hangers, claps, rods inserts.

K. All supporting methods and devices must be approved by the Architect prior to installation. No overloading of any beam, joist, slab, device, etc. will be allowed. Welding to and drilling of structural members must be approved by the Architect. Coordinate support locations with other Contractors.

3.05 Water Heater Installation

A. Furnish and install ASME rated temperature-pressure relief valve with temperature sensing element directly inserted into tank. Pipe relief full size to drain using copper piping.

B. Furnish and install cutoff valves and dielectric unions in hot and cold connections to water heater.

C. Furnish and install safe pans under water heater. Drain safe pan to a conspicuous location.

3.06 Floor Drain Installation

A. This contractor shall be responsible for proper setting and elevation of all floor drains to provide proper slopes and avoid water puddling on floors.

3.07 Access Doors

A. Furnish and install access doors over all concealed valves, and other concealed components requiring service and not accessible from utility spaces. All access doors shall be as manufactured by Inland Steel Products Co. "Milcor" styles as required to match construction and as approved by Architect.

3.08 Excavation and Backfill

A. Contractor shall perform all excavation and backfill required for all plumbing work. Cutting of any concrete required by the excavation shall be done by the General Contractor. Any rock shall be excavated 3" below the laying depth, and the trench shall be filled in 6" layers and mechanically compacted. Flooding or puddling not permitted. All piping which will be under concrete or roads, shall be backfilled in accordance with Architects specifications.

3.09 Waterproofing

A. Plumbing work piercing weatherproof construction shall be made weatherproof by use of Architect approved materials and methods.

3.10 Tests and Adjustments

A. Fixtures and equipment shall not be concealed or covered until they have been inspected and approved by the Architect, who shall be notified when the work is ready for inspection. All work shall be completed installed, tested as required by this Section, and leak-tight before inspection if requested. All tests shall be repeated to the satisfaction of those making the inspection.

1. All waste and vent piping shall be filled with water to the highest point in each system with all air removed. The lines shall be flushed by removing the test plug. Piping concealed shall be subjected to not less than 10' head. Stand piping installed for head test shall be min. 2" diameter.
2. Sewer piping and storm water piping shall be filled with water to its highest point.
3. Water and gas piping shall be flushed out, tested at 100# PSI for 24 hours, then left under pressure of supply main for the balance of construction period.
4. Plumbing fixtures shall be filled with water and checked for leaks or retarded flow.
5. All flush valves, key stops, valves and similar equipment shall be adjusted and balanced to provide for the proper operation of the various systems.
6. Each piece of plumbing equipment and the entire plumbing system shall be adjusted and readjusted as required to insure proper functioning and shall be left in 1st-class operating condition.

3.11 Expansion

A. Contractor shall provide for min. 1-1/2" expansion per 100 linear ft. of piping by installing swing joints and/or expansion compensators.

3.12 Sterilization of Water Distribution System

A. When the new water distribution system has been flushed thoroughly, it shall be sterilized in accordance with the requirements of the Health Department having jurisdiction or, in the absence of such, by the following:

1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling the lines slowly and applying the sterilizing agent at a rate of 50 parts per million of chlorine as determined by residual chlorine tests at the ends of the lines. Open and close all valves and hydrants while the system is being chlorinated.
2. After the sterilizing agent has been applied for 24 hours, test for residual chlorine that is indicated, repeat the sterilization process.

3.13 Cutting, Patching And Piercing

A. Obtain written permission of the Architect before cutting or piercing structural members. If, in the process of the mechanical work, ducts, piping or equipment need to be installed in an area after it has been completed, the area shall be left in the same condition it was originally. Patching and/or refinishing will be determined by the Architect.

3.14 Access

A. Equipment, valves and devices shall be mounted in a manner which provides adequate maintenance, inspection access and work space. Where access is required for adjustment, cleanout, inspection of maintenance and such access is not otherwise available, access panels shall be furnished and installed. Panels shall be selected by the Architect.

3.15 Building Openings for Admission or Installation of Equipment

A. The Contractor shall ascertain from his examination of the Architectural and Structural Drawings whether any special temporary or permanent openings in the building for the admission or installation of apparatus furnished under this Contract will be necessary and he shall notify the General Contractor accordingly. He shall pay all cost of making such openings in case of failure to give this notification in time for the General Contractor to arrange for same during construction.

3.16 Cutting, Sleeves, Inserts, Anchor Bolts and Escutcheons

A. In placing sleeves, inserts, anchor bolts and any other material to be embedded in masonry and concrete or built into the structure, the Contractor shall cooperate with all other trades and shall consult with the Architect in regard to their exact location whenever there is any interference with structural members.

B. The Contractor will be held responsible for locating and maintaining in proper position, sleeves, inserts and anchor bolts supplied and/or set in place by him. In the event that failure to do so requires cutting and patching of finished work, it shall be done at the Contractor's expense.

C. All pipe passing through floors, walls or partitions shall be provided with sleeves having an internal diameter 1" larger (unless specifically indicated otherwise) than the outside diameter of the pipe.

D. Sleeves through outside walls shall be Schedule 40 black steel pipe. Sleeves shall extend 1/2" beyond each side of the wall. The space between the sleeve and the pipe shall be packed and made watertight with a waterproof compound.

E. Sleeves through interior partitions shall be 22 gauge galvanized sheet steel set flush with finished surface of partitions.

F. Inserts shall be individual or strip type of pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4" in diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods to be passed through the insert body and shall be similar to Fee and Mason Fig. 188 or equal for equipment suspension and Fig. 9000 or equal for pipe suspension.

G. Where sleeves or inserts are placed in interior walls or partitions, the openings shall be completely sealed with Fiberglass to prevent sound transmission. Where sleeves are placed in fire rated walls and floors, they shall be packed with high temperature mineral wool and non-flammable sealant.

H. Furnish and install escutcheons where uninsulated pipes pass through finished walls, floors or ceilings. Escutcheons shall be chrome plated brass, firmly secured to the pipes and of sufficient outside diameter to amply cover the sleeved openings for the pipes. Escutcheon plates shall be as manufactured by Crane Company or equal.

3.17 Sound and Vibration

A. All pumps, motors etc. shall be mounted so as to be isolated from the building by approved sound insulation means. All noises and hums of motors, fan etc. shall be so absorbed that the operation will not be heard except in the immediate vicinity of the equipment.

3.18 Cleaning of Equipment and Removal of Rubbish

A. All equipment furnished or installed by this Division shall be thoroughly cleaned. At the completion of the work, the Contractor shall remove from the buildings and the premises all rubbish and debris resulting from his operations and shall leave all material and equipment furnished by him and the space occupied by them absolutely ready for use.

B. Under no circumstances shall rubbish be allowed to accumulate in the building or on the premises. All dirt and rubbish resulting from this Division's work shall be

removed by this Division from time to time and as often as directed by the Architect and Owner's representativ

3.19 Record Documents

A. Blueline or blackline copy of Drawings shall be kept by this Contractor at the job site at all times for the sole purpose of recording horizontal and vertical location of all concealed and underground plumbing, referenced to permanent visible structures. At completion of job, neatly record all dimensions on a reproducible drawing and submit for approval of Architect.

END OF SECTION

DIVISION 15000
SECTION 15200
FIRE PROTECTION

PART I - GENERAL

1.01 Drawings and general provisions of contract including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

1.02 Work Included

A. Automatic Sprinkler System

B. This specification for the fire protection work is intended to be a performance type specification for the furnishing and complete installation of a fire protection automatic dry pipe sprinkler system for complete coverage of the entire building, and to conform to the requirements of NFPA Bulletin 13, 20, International Building Code and ISO. The work shall include the connection to water service piping, and all equipment and materials and the complete installation and testing of the automatic sprinkler system to conform with NFPA 13, ISO, International Building Code (Seismic design) and as herein specified. Sprinkler system shall be designed for LIGHT HAZARD OCCUPANCY.

1.03 Related Work

A. Painting by Painting Contractor

B. Cutting & Patching by General Contractor.

C. Fire Extinguishers - See Architectural Plans

1.04 Codes & Standards

A. International Building Code

B. NFPA 13

C. ISO

1.05 Shop Drawings

A. The Contractor shall prepare and submit shop drawings with hydraulic calculations to the Engineer for approval, showing each fire protection system complete, including but not limited to, test and drain valves and connections,

sprinkler heads all piping with sizes and drains. Submittals shall also include manufacturer's data sheets on all equipment and materials included in system. Shop drawings shall be sealed by an Engineer registered in Missouri.

B. Items of work not specifically mentioned in this specification shall be furnished and performed in accordance with applicable requirements of NFPA #13 and ISO.

1.06 The contract drawings for fire protection work are in part schematic, intended to convey the scope of work and indicate the general layout, design and arrangement. The Contractor shall follow these drawings in the layout of his work and shall consult general construction drawings, mechanical/electrical drawings and all other drawings for this project to determine all conditions affecting the fire protection work. The contract drawings are not to be scaled and the Contractor shall verify spaces in which the fire protection work is to be installed. An Autocad drawing with walls, reflected ceiling, grilles, and registers will be provided at the request of the successful bidder.

1.07 Where specific details and dimensions for fire protection work are not shown on the drawings, the Contractor shall take measurements and make layouts as required for the proper installation of the work and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications that have not been clarified by addendum prior to bidding, it shall be assumed by the signing of the contract that the higher cost (if any difference in costs) is included in the contract price, and the Contractor shall perform the work in accordance with the drawings or with the specifications, as determined and approved by the Architect, and no additional costs shall be allowed by the contract price.

1.08 Quality Assurance

A. ISO Listing: Provide component materials which have been evaluated and approved by ISO.

1. Plans shall be submitted to ISO for approval.

1.09 Design

A. The system shall be hydraulically designed. Verify pressures with the water utility company prior to preforming hydraulic calculations. Hydraulic calculations shall be sealed by an Engineer registered in Missouri.

PART II - PRODUCTS

2.01 Piping Materials

A. Piping inside building shall be plastic approved for sprinkler piping.

B. Piping shall be sized, in accordance with NFPA 13 and ISO. All pipe sizes shall be shown on shop drawing submittals, and all calculations and information required for the sizing in accordance with NFPA 13 and ISO shall be submitted with the shop drawings.

2.02 Sprinkler Heads

A. Sprinkler heads shall be Central or equal by Viking or Reliable.

B. Installation shall comply with the requirements of NFPA 13 and ISO.

C. Provide spare sprinkler heads, of the types installed and wrench in a suitable steel cabinet with hinged door and latch. Number of spare sprinkler heads, of each type installed, shall comply with NFPA 13 and ISO.

D. If additional sprinkler heads are required, (due to obstructions) to provide the coverage as required by NFPA Standards and as hereinbefore specified, then the additional heads shall be furnished and installed, and piping size increased as necessary to comply with the NFPA Standards at no additional cost to the Owner.

E. Provide chrome plated brass 2-piece escutcheon plate which allows escutcheon installation after ceiling tile is in place.

2.03 Alarm

A. Provide approved water flow switch and bell which sounds upon water flow in system. Water flow switch shall also initiate alarm through fire alarm system to notify emergency personnel. Provide valve tamper switches to initiate alarm through Fire Alarm System.

2.04 Escutcheon Plates

A. Provide escutcheon plates around exposed pipes (pipes not concealed by construction) where they pass thru ceilings, walls or partitions. Plates shall be chromium plated, cast or heavy stamped brass. Secure plates so that they will not pull away from construction when pipe expands and contracts.

2.05 Color Banding and Identification of Piping

A. The Contractor shall provide color banding with legend identification of piping as herein specified. Band colors and identification legends shall be as selected by Owner.

B. All exposed pipes and all pipes located above accessible ceilings shall have color bands with legends at intervals not to exceed 20 feet apart. Where pipes are located in accessible concealed locations such as shafts, pipe spaces, chases, etc., or wherever access panels are installed at the nearest point of access to the space and in the most conspicuous location. Color bands with legends shall also be located on pipes adjacent to all cut-off valves and adjacent to each pipe of equipment.

C. Identification legends shall be made of pressure-sensitive vinyl type with background color as scheduled and with plain block or Roman letters in a contrasting color and letters of height as follows: 1/2" high for 1/2" through 1-1/2" pipe size; 3/4" for 1-1/2 and 2" pipe; and 1-1/4" for 2-1/2" through 6' pipe; 2-1/2 for 8" and 10" pipe; and 3-1/2" for over 10" pipe size. If the identification legend tape does not extend completely around pipe and with at least 1/4" overlap, furnish and install a band of matching color, pressure sensitive vinyl tape around pipe at each end of the identification legend tape. These bands shall be installed around the complete circumference of the pipe and shall overlap not less than 1/2" and shall overlap the ends of the identifications legend by 1/2" to 1". Adjacent to each identification legend, furnish and install a pressure-sensitive vinyl arrow marker tape showing the direction of flow.

D. Where possible, the identification legends shall be installed where they can be easily read from standing on the floor.

E. Color banding with legend identification shall not be installed until piping has been insulated and painted, for pipes that are to be insulated and painted. Surface of insulation or pipe on which the color banding is to be installed shall be thoroughly clean before installation of banding is made.

F. Identification legends may be abbreviated from or full lettering, conforming with ANSI Standards A13.1, but identification description shall not be less than shown in schedule. Markers shall be as manufactured by Seton Name Platre Corporation or Brady, or approved equal.

G. The Contractor shall furnish a framed copy of the pipe identification legends mounted under plexiglass and shall install in location as directed.

2.06 Labels and Valve Tagging

A. All main manual valves and all control valves throughout the building shall be identified with a stamped brass or plastic tag attached to the valve with a brass "S" diameter and with 1/2" depressed black letters. A list of all valves shall be mounted in a frame with plexiglass cover and shall be permanently fastened to wall in location as directed. Valve lists shall include the following:

1. Valve identification number.
2. System designation (PLBG.CW";"CH.WTR.SUP.";etc.)
3. Type valve (gate; ball; auto. control; etc.).
4. Manufacturer and manufacturer's catalog number.
5. Location of valve.

B. All mechanical equipment shall be identified with engraved phenolic nameplates. All starters, disconnect switches, controls and control panels furnished under Division 15 shall also be identified with engraved nameplates, showing the name of equipment controlled. Plates shall be black with white core and shall be securely attached to equipment with screws. List of plates with proposed working shall be submitted to the Architect for approval prior to manufacturing of plates and installation. Dymo type labels not accepted.

2.07 Substitutions

A. All substitutions must be pre-approved by the architect prior to bidding. See Division 1 for substitution process.

PART III - EXECUTION

3.01 Installation

A. The mechanics for this work shall cooperate with the mechanics for all other work in the building. The installation of piping and sprinkler heads shall be coordinated with existing conditions and all other construction, including but not limited to, the ductwork, piping, conduits, lighting fixtures, acoustical ceilings, and building structures. Any conflicts that occur with the work of other trades as a result of the lack of coordination by the installers of the fire protection work shall be adjusted at the expense of the fire protection subcontractor and as required and approved by the Architect.

B. Arrange with Contractors of other trades for installation of built-in items, blocking, and additional necessary supports.

3.02 Sleeves

A. Sleeves shall be furnished and installed wherever pipe passes through walls, partitions or floors, and the space between the pipe and sleeve shall be packed. Sleeves, packing and installation shall comply with requirements as specified in Section 15100 paragraph 3.15 of the specifications.

3.03 Sprinkler

A. Sprinkler design shall not exceed 52,000 sq.ft. per system.

3.04 Testing and Piping Systems

A. All piping shall be tested hydrostatically with 200 psi pressure in accordance with NFPA and ISO. Test pressure shall be maintained on piping system for a period of not less than 2 hours. Test shall be made before piping is painted or concealed in any manner. If leaks occur, they shall be corrected and the system shall be retested for the 2 hour period.

3.05 Record Drawings

A. Blueline or blackline copy of Drawings shall be kept by this Contractor at the job site at all times for the sole purpose of recording horizontal and vertical location of all concealed and underground piping, referenced to permanent visible structures. At completion of job, neatly record all dimensions on a reproducible drawing and submit for approval of Architect.

3.06 Operating Instructions and Maintenance Data.

A. Upon completion and acceptance of the work by the Owner, the Contractor shall provide four(4) sets of 8 1/2" x 11" typed operating and maintenance instructions. Sample maintenance instructions will be provided by Engineer upon request.

END OF SECTION

DIVISION 15000
SECTION 15300
HEATING, VENTILATING, AND AIR CONDITIONING

PART I - GENERAL

1.01 Related Documents

A. Provision of General Requirements, Division 1, are a part of this section.

1.02 Description of Work

A. The extent of work is shown on drawings, and includes but is not necessarily limited to the following:
   1. Ductwork
   2. Grilles, Registers, Louvers
   3. Neutral Air Heat Pump
   4. Water Source Heat Pumps
   5. Boiler
   6. Condensate Piping and Insulation
   7. Pumps
   8. Condenser Water Piping
   9. Fluid Cooler

B. Prior to bidding, all Contractors shall visit the site and become familiar with all existing conditions, which will affect construction procedures and scope of work required as part of this Section.

1.03 Related Work

A. Power and control wiring

B. Painting

C. Cutting and patching

1.04 CODES AND STANDARDS

A. American Society of Mechanical Engineers

B. American Society for Testing and Materials

C. American Society of Heating, Refrigerating and Air Conditioning Engineers.

D. Building Officials and Code Administrators International, Inc.

E. Sheet Metal and Air Conditioning Contractors National Association.

F. Underwriter's Laboratories

G. NFPA

H. International Approval Service

1.05 Design Conditions

A. HVAC system design assumes the following:
1. Winter outdoor temperature -10° F.
2. Winter indoor temperature 72°
3. Summer outdoor temperature 95° F. D.B. 78° F W.B.
4. Summer indoor temperature 76° F. D.B.

PART II - PRODUCTS

2.01 ROOFTOP WATER SOURCE HEAT PUMP WITH INTEGRAL ENERGRY RECOVERY WHEEL

A. GENERAL: Furnish and install water source cooling/ heating unit with integral energy recovery wheel per plans and specifications. Capacity and Energy Efficiency shall not be less than scheduled. Unit shall be provided with factory installed options listed below. Performance ratings shall be in accordance with ARI Standard 13256 – Boiler Tower. Unit shall be manufactured by Addison Products or approved equal by Mammoth, Venmar, Governaire, Webco or McQuay. Approved equal manufactures must strictly comply with unit specifications and scheduled performance.

B. APPROVALS: Unit shall be design certified to conform to appropriate UL Standards by Electrical Testing Laboratories or other nationally recognized testing laboratory.

C. FACTORY CERTIFIED TESTING: The unit shall be completely factory assembled, prewired and thoroughly leak and safety control tested. After assembly, each unit shall be charged and run tested. Certified factory test check documentation shall be provided.

D. CABINET: The unit shall be constructed with heavy duty minimum 20 gauge G-90 galvanized steel. Access doors shall be minimum 20 gauge steel with 1” 4# density closed cell insulation and a 24 gauge steel liner. The cabinet shall be double wall construction. Standard outer panels will be insulated with 1" 4# density closed cell foam insulation with a 24 gauge galvanized steel interior liner. Service access doors

shall also be mounted with stainless steel hinges and equipped with 1/4 turn cam operated adjustable compression type latches. The underside of the base panel shall be insulated with 3/8” closed cell foam insulation. Each roof section shall be joined to the adjacent section by a buttonhook seam connection and shall be sloped for proper drainage. All openings through the base pan of the unit shall have upturned flanges of at least 1/2” in height. The design of the cabinet shall allow access to the compressor and electrical panel without impairing unit operation. The compressors shall be mounted on a platform under the sloped condensers for easy serviceability. The open area under the condensers and around the compressors shall have a wire coil guard to protect the condensers as well as the compressors. Cabinet shall be designed for vertical supply and return air or horizontal supply and vertical return air.

E. UNIT FINISH: Constructed of hot dipped galvanized G90 steel that is chemically treated with zinc phosphate, coated with 0.2 to 0.3 MIL polyurethane primer then finished with 0.7 to 0.8 MIL polyester top coating. Finish shall meet or exceed 2,000 hours Salt Spray Test per ASTM B117-97.

F. IAQ CONDENSATE DRAIN PAN: The condensate drain pan shall be sloped to comply with ASHRAE Standard 62-1089R and shall be fabricated from 20 gauge stainless steel. The bottom of the condensate drain pan shall be insulated with 5/8" closed cell neoprene insulation. The drain pan shall be furnished with an MPT drain fitting positioned at the exterior of the cabinet. The weight of the coil and other components shall not compress the insulation thus reducing its insulation value.

G. SUPPLY FAN SECTION AND EXHAUST FAN: The standard fan assembly shall be a DWDI forward curved fan assembly mounted on rubber vibration isolation. The shaft is belt driven with adjustable drive sheave connected to a nominal 1725 RPM open drip proof motor with sealed ball bearings. Adjustable V-belt drives shall be provided with a minimum rating of 140% of the motor nameplate brake horsepower when the adjustable pulley is at the minimum RPM. The bearings on both the blower shaft and motor are permanently lubricated. The supply fan shall be on a slide out deck for removal from the cabinet to service or inspect.

H. REFRIGERATION SYSTEM: The refrigerant system(s) shall operate with R-410A refrigerant and shall include the compressor, crankcase heater, copper-tube, aluminum finned condenser and evaporator coils. The refrigerant circuit shall include filter-drier, high pressure safety control (manual-reset), low pressure control/loss of charge protector (auto-reset), dual gauge connections for high and low pressure readings and thermal expansion valve with adjustable superheat. Multiple compressor models shall have split-face coils for maximum cooling at part load cooling conditions. Compressor shall be warranted by manufacturer for 5 years from date of installation. The condensing section of the unit shall be integral to the unit and shall be manufactured by the air conditioning unit manufacturer. The unit shall be configured for a Water Source

Heat Pump (Geothermal) Condensing Section. The Coaxial Water Coil for Geothermal Applications consists of an enhanced surface inner copper tube with outer steel tube shell (tube-in-tube) and have fully Insulated refrigerant and water lines and polyurethane foam encased coaxial water coil

I. EVAPORATOR COIL: Evaporator coil shall be sine wave shaped aluminum fins formed on multiple rows of seamless 3/8” rifled copper tubing arranged in staggered tube configuration with galvanized steel header plates. These tubes are mechanically expanded, firmly bonding the tube to the shoulder of each fin.

J. ELECTRICAL: The units shall be designed for electrical power entry through the curb. The unit shall include a mounted control panel with a modular Integrated Motor Control System with Micro Logic Control all mounted on din rails. The Micro Logic Control is by PLC (Programmable Logic Controller). All indicated safety and operating controls shall be factory mounted and connected to a bus system. The bus system shall also include all relays, fan and compressor motor contactors or starters and power distribution. The 24-volt control circuit, isolated from line voltage, shall include a transformer and low voltage terminal board for external thermostat control hookup. Safety controls shall include an anti-short cycle timer on all compressors and stagger start timer on multi-compressor models.

K. DEHUMIDIFICATION CONTROL COMPONENTS: Dehumidification / neutral discharge air control shall be accomplished via hot gas reheat and liquid subcooling coil as follows:

1. HOT GAS REHEAT COIL: A factory installed hot gas reheat circuit including outlet regulator valve, check valves, modulating hot gas reheat control valve, variable speed condenser head pressure control, one stage sensor, and one row heat reclaim coil shall be provided. The coil is equal to the evaporator face area and installed in the reheat position.
2. LIQUID SUB-COOLING COIL: To further lower relative humidity (RH) in the supply air stream when a dehumidification sequences is initialized, a one row subcooling coil, equal to the evaporator face area shall be provided. Liquid sub-cooling must be provided to provide maximum dehumidification and increase the overall unit efficiency as scheduled.

L. AIR FILTERS AND RACK: The standard filter rack shall be capable of using either of 2” filters, 4” filters or 2” pre-filters and 4” final filters. Standard filters are 2” pleated.

M. ENERGY RECOVERY WHEEL SECTION: The ECW or enthalpy wheel shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to delaminating or erosion of the desiccant material. Media shall be

synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for air flow. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Ribbon type wheels or wheel layers that can be separated are unacceptable due to the possibility of channeling and performance degradation. The minimum acceptable performance shall be as specified in the drawings/submittal. The wheel shall slide out the side of the unit cabinet for easy service. The desiccant material shall be a molecular sieve, and specifically a 4-angstrom or smaller molecular sieve to minimize cross contamination. The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel seals shall be full contact nylon brush seals or equivalent. Cassettes shall be fabricated of heavy duty reinforced galvanized steel. Cassettes shall have a built in adjustable purge section minimizing cross contamination of supply air. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged bearings. Drive systems shall consist of fractional horsepower A.C. drive motors with multilink drive belts. The wheel shall be ARI certified and must bear the ARI certification stamp. Private independent testing performed "in accordance with" various standards is not a substitute for ARI certification and shall not be accepted. The wheel shall be listed or recognized by UL or equivalent.

N. VENTILATION HOOD: The unit shall be equipped with a factory installed, motorized, 2 position, Outside Air Damper (used for 100% Outside Air) with a weatherproof air intake hood and bird screen.

2.02 Ductwork

A. Rectangular - shall be galvanized iron fabricated and installed to SMACNA standards. Provide turning vanes in all 90 degrees elbows. Provide all necessary manual volume dampers, turning vanes, volume extractors, etc. as required to properly balance system. Fresh air duct and all duct in unconditioned shall be insulated with 2" ductwrap, insulation, with "K" value of .24. Duct in conditioned shall have 1 1/2" ductwrap, except in plenum areas shall have no insulation. Fiberglass ductliner is <u>not</u> allowed.

B. Round - Shall be galvanized iron fabricated and installed to SMACNA standards.

C. Flexible Duct – FLEXMASTER #6M Insulated flexible duct. Mylar inner liner, 1" thick fiberglass insulation with seamless aluminized vapor barrier. Maximum length unless otherwise noted shall not exceed 10 feet, and supported maximum 3' o.c.

2.03 Grilles and Louvers

A. Exhaust, grilles shall be fixed deflection and shall be Hart and Cooley or approved equal. All aluminum. Color as selected by Architect.

B. Supply registers in areas with no ceiling shall be adjustable curved blade, all aluminum, and supported from structure.

C. Louvers shall be Ruskin #ELF-375 all aluminum with bird screen. Color as selected by Architect.

2.04 Dampers

A. Manual dampers up to 14" may be single blade. Quadrants shall be Duro-Dyne #KP-20 series, or approved equal.

B. Motorized dampers shall be Ruskin #CD35 or approved equal with 120V. electric two-position activators with spring return, Barber Colman #MA-400 Series or approved equal.

2.05 Water Source

A. WORK INCLUDED:

1. The contractor shall furnish and install where shown on the plans, packaged water source heat pump units. Sizes, types and performance shall be as indicated in the unit schedule. Each unit shall be complete with factory furnished components and accessories as shown in the plans and as herein specified.
2. Provide labor, materials, and equipment and services to perform operations required for the complete installation and related work as required in Contract Documents.
3. Electrical work required as an integral part of the temperature control work is indicated on the mechanical drawings, and is the responsibility of this contractor to provide the complete system to perform the full sequence of operation shown, or as described in this specification.

B. SUBSTITUTIONS:

1. This is a performance specification which uses the first named manufacturer's equipment as basis of design. Other manufacturers are named as acceptable, providing the other named manufacturers comply fully with all construction details, scheduled performance requirements, and the full scope of these specifications. This does not necessarily mean that the other named manufacturers equipment will fit the available space or design requirements. It

shall be the responsibility of this contractor to be sure that the system provided fully meets or exceeds the specified requirements, and should any changes or additional apparatus be required for other named manufacturers, this contractor shall be fully responsible for the material and installation cost (including claims by all other trades which may be effected by the substitution), to complete the installation to comply fully with the systems as outlined in these plans and specifications. A request for a substitution shall constitute a representation that the contractor:

a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
b. Will provide the same warranties or bonds for the substitution as for the product specified.
c. Will coordinate the installation of an accepted substitution in the work, and make such other changes in the work as may be required for installation to make the work complete and equal to the basis of design in all respects.

2. Any manufacturer not named in these specifications shall be submitted to the engineer for technical review not less than fourteen days prior to the published bid date. The solicitation for consideration of alternate manufacturers shall include, but not be limited to, full submittal data on unit construction, performance, and shall include:
   a. Drawings and samples to demonstrate the products compliance.
   b. Outline any changes required in other elements of the work because of the substitution.
   c. Availability of local service and source of replacement material and parts.
   d. A comparison of the proposed manufacturer's equipment with that specified. A complete copy of these specifications, with a notation written in the right margin of the specification; "C" for full compliance, or "D" for deviation, for each specification line item. For every instance of deviation, a full explanation shall be attached, identified by specification number.
   e. A list of local installations where equipment of like and kind have been installed with names and telephone numbers of personnel for each installation that may be contacted as references.
3. The engineer shall determine compliance with the specification and whether or not the proposed manufacturer's equipment is acceptable for bid submission. Any deviation from this procedure is not acceptable and shall disqualify the proposed manufacturer. Acceptance and approval of any proposed equipment by the engineer for bid submission shall not be interpreted to imply that the proposed equipment will fit the available space or the dimensional or design requirements. The engineer will review requests for substitutions with reasonable promptness, and the decision to accept or reject the requested

substitution will be responded to only by addendum. The engineer may request additional information, which must be provided and reviewed before determining compliance. If the engineer finds the product to be of general acceptance, an addendum will be issued adding that manufacturer's name. If not added by addendum, that manufacturer's equipment will not be allowed or considered for the project if submitted.

4. The judgment of the engineer shall be final.

C. SUBMITTALS

1. Shop drawings including weights, dimensions, and required clearances for service.
2. Electrical data, including minimum circuit ampacity and maximum overcurrent protection required, time delay fuse type or HACR circuit breaker required.
3. Computer generated Certified Performance data at project application conditions.
4. Installation details.

D. QUALITY ASSURANCE:

1. Heat pump performance data shall be certified in accordance with ARI/ISO Standard 13256-1 and shall have the correct ARI/ISO and CUL labels affixed to the cabinet. Heat pump performance at scheduled project operating conditions shall be substantiated by computer generated output data.
2. Heat pumps shall be listed by a nationally recognized safety testing laboratory, or agency, such as Underwriters Laboratories (UL), or Electrical Testing Laboratory (ETL), or Canadian Standards Association (CSA).

E. GENERAL:

1. ELECTRICAL: All heat pump nameplate electrical utilization voltages shall be in conformance with ANSI Standard C84.1 as follows: All heat pump units shall be suitable for continuous operation with a supply voltage variation, measured at the factory power connection point, of ± 10% of the nameplate voltage. A control box shall be located within the unit and shall contain controls for compressor, reversing valve and fan motor operation and shall have a 50 VA 24-volt control circuit transformer and a terminal block for low voltage field wiring connections. Unit shall be nameplated to accept time delay fuses or HACR circuit breaker for branch overcurrent protection of the power source.

Nameplate Voltage	Phase	Distribution Voltage	Service, No of Conductors
115	1	120	2
208	1	208	2
230	1	240	2
265	1	277	2
208	3	208	3
230	3	240	3
460	3	480	3

F. CASINGS: Shall be corner post and panel construction with a 16-gauge galvanized steel base pan. Access panels shall be lined internally with acoustic type fibrous glass insulation, overcoated, with edges sealed or tucked under flanges, to prevent the introduction of glass fibers into the discharge air. All construction shall meet the National Fire Protection Association Standard 90-A. All internal sheet metal parts subject to water exposure shall be galvanized or non-ferrous and coated with a baked-on, thermosetting plastic coating.

G. CEILING SUSPENDED CONDITIONERS: Each conditioner shall be provided with a kit of four hanger bracket assemblies, each comprised of heavy steel hanger bracket, integral rubber-in-shear vibration isolator, cap screw, and plated isolator washer. Units with more than four hanger brackets SHALL NOT be accepted. Hanger bracket assembly shall accommodate a 3/8" or 1/2" diameter threaded hanger rod. No external channel or angle trapeze hangers shall be allowed.

H. CONFIGURATION: Units shall be provided configured as shown on the plans, in one of the following air-flow arrangements (Note: “Right” or “Left” side shall be determined when viewing the compressor compartment end panel):

1. Right side inlet / opposite side discharge

I. BLOWER MOTOR: A two-speed blower motor shall be provided on 70,000 BTUH (ARI/ISO cooling rated) or smaller models. Factory wiring shall be for optimal performance, with means provided for easy terminal field reconnection to alternate speed. Field wire cutting, stripping, or terminal application to conductors shall not be required for motor speed change.

J. BLOWER: All conditioners with direct drive blowers shall be side or end discharge, as shown on Drawings. The blower discharge shall be interchangeable from side to end-discharge or vice-versa by field exchange of the blower panel and fan mounting panel. Units shall have a removable orifice ring to facilitate blower wheel and motor removal without the need to disconnect duct work. Units without orifice ring are not acceptable.

K. REFRIGERANT CIRCUIT: A sealed refrigerant circuit, consisting of a high efficiency scroll, rotary, or reciprocating hermetic motor-compressor mounted on rubber isolation grommets (spring isolators shall not be accepted), air-to-air refrigerant finned tube coil, refrigerant flow metering device, water-to-refrigerant coaxial tube type heat exchanger, high pressure safety cutout, and fusible pressure relief factory-installed on the refrigerant circuit. Heat pump conditioners shall additionally contain a pilot-operated refrigerant reversing valve. The reversing valve shall be energized for heating operation. High and low side refrigerant service valves shall be provided. The refrigerant flow metering device shall be a thermostatic expansion valve. Refrigerant will be HCFC R22.

L. SAFETY CONTROLS: High pressure, low temperature shall be wired through a latching lockout circuit to hold the conditioner off until it is reset electrically by interrupting the power supply to the conditioner. Automatic reset by wall sensor switching shall not be allowed. All safety switches shall be normally closed, opening upon fault detection. Control logic dependent upon the closing of a normally open switch shall not be allowed to preclude the possibility of simple, easily corrected faults being escalated into compressor or heat exchanger failure due to loss of integrity in the control wiring..

M. SAFETY CONTROLS: High pressure, low temperature, and low pressure safety switches shall be wired through a latching lockout circuit to hold the conditioner off until it is reset electrically by interrupting the power supply to the conditioner. Automatic reset by wall sensor switching shall not be allowed. All safety switches shall be normally closed, opening upon fault detection. Control logic dependent upon the closing of a normally open switch shall not be allowed to preclude the possibility of simple, easily corrected faults being escalated into compressor or heat exchanger failure due to loss of integrity in the control wiring.

N. COLD START-UP: Manufacturer shall guarantee heat pump conditioners to start and operate in an ambient temperature of 40 degrees F with entering air at 40 degrees F, with entering water at 70 degrees F, with both air and water at the flow rates used in the ARI/ISO standard rating test, for initial system start-up in winter. (This is not a normal or continuing operating condition, and it is assumed that such a start-up is only for the purpose of bringing the building or space up to initial occupancy temperature.)

O. AIR SECTION - The air section of the unit shall be isolated from the compressor and control section with an insulated divider panel, to minimize the transmission of compressor noise, and to permit operational service testing with the compressor compartment cover removed, without having air bypass the air-to-refrigerant coil.

P. FILTERS - All conditioners shall be provided with a one-inch thick, throwaway type fiberglass filter installed in a factory mounted four-sided filter frame, arranged for "side-pull". The frame shall be able to be field rearranged by the contractor to accommodate up or down pull, as required, to ensure that the completed installation is serviceable.

Q. Supply and return, connections shall be FPT fittings, brazed to copper water tubes and securely mounted flush to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench. Condensate drain connection shall be not be less than 3/4" FPT fitting securely mounted flush to the cabinet base pan. Supply, return, and condensate shall be connected to loop and drain piping as detailed on plans. Piping connections at the unit which require brazing or soldering by the installer (which might damage the unit) shall not be allowed.

R. PLASTIC DRAIN PAN: Units shall be standard with a plastic, double-sloped drain pan. Metal drain pans are not acceptable.

S. CONTROL SYSTEM: Shall be compatible with owner's temperature control by EPM, Inc. (573) 642-6550 (Jim Johnson)

T. WARRANTY: Contractor shall provide one full year warranty for furnishing parts on site, and labor to replace any part of the unit which becomes defective in normal operation, from the date of start-up by the manufacturer's representative, or first beneficial use of the unit. The hermetic motor compressor shall be warranted for an additional four years.

1. Manufacturer's warranty time periods may or may not coincide with the contractor's time period of obligation, but where the manufacturer's warranty contains an expiration date based upon the equipment shipping date, the contractor shall not be relieved of responsibility for covering the full time periods listed above.
2. The contractor shall be responsible for all shipping expenses not included by the manufacturer, both to procure the replacement part, and to return any defective parts to the manufacturer, as they may require.
3. The contractor's replacement warranty obligation after the first year shall be limited to furnishing of replacement parts only, and shall not include repair labor costs or materials such as refrigerant, oils, dehydration, refrigerant moisture dryers, air filters, or drive belts.
4. The owner shall be responsible for providing replacement filters beyond the spares provided in the original contract, and for filter installation labor.

U. OPTIONS: DESIGNER SELECT AS REQUIRED FOR THIS PROJECT:

1. Provide and install on each heat pump unit a complete self balancing supply and return hose kit, as specified elsewhere.

V. DESIGNER NOTE:

1. Provide the following option for heat pump units shown with a return air duct:
   a. Provide and install on each each heat pump unit with a field installed combination return air filter holder and duct collar kit. The kit shall be capable of accepting either one or two inch filters, and shall be arranged to accommodate either side or vertical filter changes.

W. DESIGNER NOTE:

1. Provide Wall Sensor for use with MicroTech OR Alterton DDC unit controls ONLY. Note that the manufacturer's wall sensor is mandatory with both providers:
   a. Basis of Design
      i. Model by McQuay International.

b. Acceptable Alternates

i. With prior approval only, submit a detailed summary listing of all variations in form, fit, or function, in addition to specified submittal data.

X. EXECUTION

1. Installation:

a. Install equipment in strict accordance with manufacturer's instructions and to as to be compatible with intent of the respective system performance requirements.

b. No field provided apparatus, electrical or mechanical, shall be fastened to the heat pump cabinet with screws, without the prior written approval by the manufacturer’s representative.

c. A discrete grounding conductor shall be provided, sized in accordance with the National Electrical Code, for each heat pump unit. The use of conduit or water piping for grounding purposes shall not be allowed.

d. Piping, electrical conduits, lighting fixtures, etc. shall not be located under any ceiling suspended unit, so as to interfere with unit removal for service or replacement.

e. Piping and electrical connections shall be located to eliminate any interference with removal and replacement of the filter.

f. Contractor shall clean each unit of construction dust and debris:

i. and install new filters at time of commissioning,

ii. and shall supply to the owner one complete set of spare filters for each unit on the project.

2. Heat pump units shall not be used as “construction heaters” at any time during any phase of construction. Very low temperatures, harmful vapors, gypsum dust from dry wall finishing, may all damage the unit and affect its efficiency and useful service life. Failure to properly protect the unit from construction dirt and debris and from condensation forming within the unit may cause electronic component failure, and void the manufacturer’s warranty.

3. Coordinate installation with work as part of "Control Systems" Section.

4. Manufacturer’s Field Service: Engage the services of factory authorized service technician representative to provide equipment Start Up to verify installation for proper operation and compliance with manufacturer's recommendations, and to assist the contractor in making adjustments, and to assist in field testing as follows:

a. Inspect for visible damage to casing, coils and internal parts.

b. Inspect for visible traces of refrigerant leaks (oil, etc.) and then leak check.

c. Inspect all electrical connections and torque to manufacturer’s recommendations, both power and control. Verify correctness.

d. Verify that filters are provided as specified and are installed properly.

e. Verify that proper clearances for both operation and servicing have been provided.

f. Verify that the unit has been cleaned of all construction dust and debris.

g. Verify proper fan rotation and v-belt drive alignment and tension where applicable.

h. Start unit according to the manufacturer's written instructions.

i. Observe initial unit operation to verify suitability for continuous operation for a period of time of sufficient duration to permit system air balancing.

2.06 TEMPERATURE CONTROLS

1. GENERAL

A. Provisions of DIVISION 1 - GENERAL REQUIREMENTS and DIVISION 15 - SECTION 15100 - MECHANICAL CONDITIONS are a part of this Section whether attached hereto or not.

2. DESCRIPTION OF WORK

A. Furnish all labor, services, materials and related items necessary to complete the control work indicated on the drawings and/or specified herein. Work to be performed shall include, but not be limited to, the following items:

1) Furnish manufacturer components of electric or electronic temperature controls, complete with all necessary and specified control points, graphics packages, thermostats, relays, valves, dampers, etc., for a complete heat pump operating system.

2) Provide electric or electronic control components as required to control and interlock packaged equipment to provide all control points and graphic specific as part of this complete building control system.

3) WEB Based interaction through the internet: The control system shall use browser software and an Internet connection to log on to the building automation system. Using the browser the owner shall have the ability to access data displays, operator activity logs, trendlogs, current alarms (view & acknowledge) and alarm history, energy logs, and tenant activity logs. Remote dial up software and software keys shall be provided as backup, but the BMCS shall be accessed via the internet.

Passwords and user profiles shall restrict access only to authorized personnel. The Web based server shall be a self-contained Internet appliance that requires little configuration or setup. Data displays are sourced from the Windows server and converted for a consistent interface.

3. TEMPERATURE CONTROL

A. It shall be the responsibility of the Contractor to provide a complete control system as hereinafter described.

B. It shall be the responsibility of the Contractor under this Section to furnish, install, test, calibrate and place the control system into proper operation. This shall include all controllers, all controlled devices, relays, control voltage transformers, control voltage wiring (less than 100), etc., required to accomplish a complete and operating system providing the sequence as called for on the drawings or in the specifications.

C. Unless otherwise noted, interlock wiring shall be furnished and installed under DIVISION 16.

D. The Electrical Contractor shall furnish and install power wiring for the HVAC temperature control system. This control power wiring shall be taken from a spare circuit in a nearby electrical panel, and circuit shall be marked in panel directory.

E. All Controls shall be by one manufacturer. (Honeywell)

F. Controls are based on an electric or electronic control system, utilizing manufacturers standard control components and unless specifically stated otherwise, all controls shall be electric or electronic.

G. Unless specifically noted otherwise, electrical control devices shall be 24V, and this subcontractor shall furnish and install all wiring, transformers, relays, etc., required for proper and safe operation.

H. Unless noted otherwise, electrical control devices specified to be 120V shall be mounted under this Section and wired under DIVISION 16.

I. It shall be the responsibility of the Contractor to coordinate with the equipment suppliers and the temperature control suppliers to furnish a complete system of controls.

J. All wiring furnished and installed shall be in compliance with the National and Local Electrical codes. Wiring shall be in conduit.

K. All controllers shall be mounted in a workmanship like manner and shall be clearly and permanently marked as to function. Controllers shall be located where easily accessible.

L. Automatic temperature control valves and thermal wells for immersion elements shall be furnished and installed by the Contractor.

M. Heat Pumps:

The heat pump manufacturer shall furnish and the Mechanical Contractor shall install a factory assembled and wired Solid State Electronic Loop Water DDC Control System to:

1) Monitor the flow of water in the loop, and its temperature.

2) Sound alarm and indicate fault in the event of loss of water flow or water temperature above or below the maximum or minimum control safe limits.

N. Control Dampers:

1) Furnish and install multi-blade louver type with blade seals, "V" grooves in the blades for maximum rigidity and overlapping lips. Damper blades shall be No. 16 gauge with frames of approved reinforced flat iron or angles of galvanized iron painted with two coats of rust resistant paint. All bearings shall be DuPont Nylon ZYTEL-1-1 with brass or stainless steel pins. All dampers shall have Urethane Foam Strips glued to the damper blades. Damper blades shall be opposed acting. Particular care shall be taken that all dampers close tight. They shall be guaranteed to have no more than 3% leakage under operating conditions. No dampers over 16 square feet shall be permitted; where openings require same, more than one damper shall be used with a motor for each damper.

2) All damper motors shall be electric.

3) Fresh air/exhaust air dampers shall be normally closed and shall be interlocked with the fan motor.

O. Thermostats:

1) Thermostats shall allow for local control of heat/cool setpoint, heat pump parameters and setback/override.

2) Each thermostat shall be mounted on a suitable base and located where directed. Thermostats in ducts or casings shall be insertion type with extra long stem with the thermostat element in the air stream and the mechanism located in an accessible space. Thermostat element in fan discharge, hot air plenum or cold air plenum shall be twice the length of the fan discharge or plenum. Thermostats in water lines shall include wells.

P. Low Limit Thermostats: Low Limit Thermostats shall be of the manually reset type and shall be provided with a sensing element which shall respond to the lowest temperature to which any one (1) foot portion is exposed. Set point shall be adjustable. Low Limit Thermostats shall be 120/1/. Wiring between Low Limit Thermostats and other controlled devices, such as damper motors, shall be furnished and installed by the Contractor.

Q. Fire Detection Thermostats: Firestats shall be of the manually reset type and shall have an adjustable set point. Firestats shall be 120/1/. Provide firestats on all fans over 2000 CFM and less than 15000 CFM.

R. Line Voltage ON/OFF Thermostats: Thermostats shall be bimetal actuated open contact, or bellows actuated enclosed snap-switch type. Thermostats shall be UL listed. Line voltage thermostats shall be 120/1/. Contacts shall be suitable for duty intended.

S. Damper Operators: All damper operators shall be electric motors with non-corrosive parts, pivot-type mounting and capable of positioning dampers. It shall be the duty of the Contractor to properly size the damper motors.

T. Control Valves: Control valves shall be furnished with electric actuators of ample size to permit long travel and positive positioning of the valve plug in intermediate positions. Valve bodies shall be rated for 150 psi minimum working pressure and shall be bronze bodies, screwed, with bronze trim for sizes 2" and under. For sizes 2-1/2" and over, bodies shall be cast iron or semi-steel with operating pressure rating of 150 psi, flanged ends and bronze trim. All valves shall have stainless steel stem and packing suitable for service intended. Valves shall allow field repacking under line pressure. Valve plugs and seats shall be field replaceable. Valves for hot services shall have operators spaced away from body to minimize effects of temperature. Pressure drop for water valves shall not exceed 10 ft. w. c. All valves shall be capable of closing against a 60 psi pressure differential without generating noise.

U. Control Panels: Control panels shall be fully enclosed cabinets, all 14-gauge furniture steel construction and shall meet the requirements of NEMA 1 enclosures. Cabinet shall be right or left hinged door with a locking latch. Provide means of storing control system instructions and drawings inside cabinet for future reference. Cabinet shall be finished with two coats of manufacturers's standard paint. Panels shall be recessed or wall mounted as shown on the drawings. All indicating devices manually adjusted during routine operation of the system, or alarm devices shall be located on the cabinet door. All other devices shall be located within the cabinet. All devices shall be clearly and permanently marked. Devices on front of panel shall be marked with engraved plastic tags secured to face of panel. Panels shall be sized to allow for the mounting of the air filter gauges.

V. Flow Switches (Water): Unless noted otherwise, flow switches shall have 120/1/ contacts, electrical rating and switching arrangement suitable for the application, UL listed, all wetted parts brass or stainless steel, extended paddle for larger pipe sizes, switch compartment completely sealed from piping connection, vapor-proof, suitable for mounting in pipe line with 125 psi operating pressure, adjustable sensitivity, and switching arrangement as required for duty. McDonnell Miller or equal. Mount flow switches with not less than 5` of straight pipe both upstream and downstream.

W. Aquastats: Aquastats shall be immersion element type with element mounted in thermal well. Aquastats shall have adjustable set point with scale suitable for applications, maximum differential of 2 F switch action and electrical rating suitable for application.

X. Flow Switches (Air): Air flow switches shall be UL listed, with adjustable sensitivity, and parts exposed to inside of duct constructed of brass aluminum or teflon. Switch compartment shall be isolated from air stream. Switches shall be equal to McDonnell Miller AF1 or AF2 series, and unless noted otherwise shall be low voltage.

Y. Where butterfly valves are used, valves shall be bubble tight close off.

Z. Shop drawings shall be submitted on the entire control system and shall include:

1) Control diagrams for each sequence.

2) Manufacturer's data on each control device.

AA. The Contractor shall review the electrical drawings to obtain location of electrical panels, motor starters, and all other coordination items.

BB. Smoke detectors will be furnished, installed and wired under DIVISION 16.

CC. Unless noted otherwise, all controls shall be proportional.

DD. Unless otherwise noted, all controls shall be failsafe.

4. DIRECT DIGITAL BUILDING CONTROL SYSTEM

A. General

1) Work Included

A. Furnish a complete BACnet-based system, including a Microsoft Windows-based distributed logic control system in accordance with this specification section. This includes all global controllers, logic controllers, and all input/output devices. Items of work included are as follows:

1. Provide all necessary BACnet-compatable hardware and software to meet the systems functional specifications. Provide P.I.C.S. for system controllers, including unitary controllers. All direct digital logic hardware to be in compliance with ASHRAE Standard 135-1995.

2. Prepare individual hardware layouts, interconnection drawings and VisualLogic software configuration from project design data.

3. Implement the detailed design for all system standard analog and binary object types, distributed control and system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

4. Design, provide and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

5. Provide and install all interconnecting cables between supplied cabinets, logic controllers, and input/output devices.

6. Provide and install all interconnecting cables between all operators terminal and peripheral devices (such as printers, etc.) supplied under this section.

7. Provide complete manufacturers specifications for all items that are supplied. Include vendor name of every item supplied.

8. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup and commissioning.

9. Provide a comprehensive operator and technician training program as described herein.

10. Provide as-built documentation, terminal software, VisualLogic diagrams and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

2) Related Work

A. Related work in other sections of the specifications:

1. Section 15010Basic Mechanical Requirements

2. Section 16010Basic Electrical Requirements

3) System Description

A. General Requirements

1. Provide a distributed logic control system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software. System shall be totally based on BACnet ASHRAE Standard 135-1995. This system is to control all mechanical equipment, including heat pumps, fans, duct coils, heat recovery units, pumps, cooling towers, central plant machinery and other specified equipment, directly without intervening electric, analog electronic, pneumatic or other non-BACnet compliant controls.

2. The entire processing system shall be completely in compliance with BACnet specification: ASHRAE 135-1995. The system shall use the BACnet protocols throughout and exclusively. Non-BACnet-compatible or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

3. All logic controllers for terminal units, air handlers, central mechanical equipment, and Microsoft Windows based operator's terminal(s) shall communicate and share data, utilizing only BACnet communication protocols.

4. The controls contractor shall assume complete responsibility for the entire controls system as a single source. He shall certify that he has on staff under his direct employ on a daily basis, factory trained technical personnel. These employees shall be qualified to engineer, program, debug, and service all portions of the BACnet based logic control system. This shall include operators terminal, global controllers, routers, terminal unit controllers, sensors and all other sections of the system.

B. Basic System Features:

1. Zone by zone direct digital logic control of space temperature, scheduling, optimum starting, equipment alarm reporting, and override timers for after-hours usage. A zone is the area served by one HVAC logic controller unit (heat pump, electric unit heater, energy recovery unit, etc.)

2. Operators terminal software shall be Microsoft Windows 95. The EMCS application program, shall be written to communicate specifically utilizing BACnet

protocols. Software shall be multi-tasking, capable of executing and displaying multiple instances in individual windows while running concurrently with other Windows programs such as word processors or database programs. Software shall support Windows Dynamic Data Exchange (DDE) interface. Software shall strictly follow Microsoft Windows API guidelines. Systems using proprietary software or operating systems other than that described above are strictly prohibited. Operation of the terminal software shall be simple and intuitive.

3. Terminal software shall contain an easy-to-operate system allowing configuration of the BACnet controller, including management and display of the controller programming. This system shall include controller binary and analog input/output configuration capability.

4. Operators terminal operating system shall be capable of utilizing third party Windows based programs for such things as spreadsheet analysis, graphing, charting, or custom report generation.

5. When specified, at least one operators terminal shall be equipped to act as a system server. This system server shall store copies of loadable software for all field components, and shall be capable of automatic or manual reloading of such software into the field components as required. The system server shall also gather and archive system operating data, such as trendlogs, energy logs, and other historical operating data.

6. Complete energy management firmware, including self adjusting optimum start, demand limiting, global control strategies and logging routines for use with total control systems. All energy management firmware shall be resident in field hardware and not dependent on the operators terminal for operation. Operators terminal software is to be used for access to field based energy management control firmware only.

7. Priority password security systems shall prevent unauthorized use. Each user shall have an individual password. The user shall only be given access to the system functions required for individual job performance.

8. Equipment monitoring and alarm functions, including information for diagnosing equipment problems.

9. The complete system, including, but not limited to terminal unit controllers, global controllers and operators terminals shall auto-restart, without operator intervention, on resumption of power after a power failure. Database stored in global controller memory shall be battery backed up for a minimum of 1 year. All other logic controllers shall utilize EEPROM for all variable data storage. Batteries on unitary controllers shall not be allowed.

10. Modular system design of proven reliability.

11. All software and/or firmware interface equipment for connection to remote monitoring station from field hardware or the operator's terminal.

12. Equipment runtime totalization of fans, heaters, boilers, etc., capable of alarm generation and alarm dialout to remote sites.

13. Room sensors with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. In conjunction with a unitary logic controller, user shall also be able to start and stop unit from the digital sensor.

14. Communication wiring for field controllers shall not be run in star patterns. (In some installations of an RS-485 communication system, depending on cable used, length of cable runs, baud rate etc., errors may be introduced.)

15. All controllers communicate utilizing ASHRAE protocols contained in the BACnet 135-1995 standard.

16. All DDC hardware and software shall be designed and manufactured by U.S. corporations. All hardware shall be Listed Underwriters Laboratory for Open Energy Management Equipment (PAZX) under the U.L. standard for safety 916, with integral labels showing rating.

17. All hardware shall be in compliance with FCC Part 15, Subpart J, Class A.

18. WEB Based interaction through the internet: The control system shall use browser software and an Internet connection to log on to the building automation system. Using the browser the owner shall have the ability to access data displays, operator activity logs, trendlogs, current alarms (view & acknowledge) and alarm history, energy logs, and tenant activity logs. Remote dial up software and software keys shall be provided as backup, but the BMCS shall be accessed via the internet.

    Passwords and user profiles shall restrict access only to authorized personnel. The Web based server shall be a self-contained Internet appliance that requires little configuration or setup. Data displays are sourced from the Windows server and converted for a consistent interface.

4) Quality Assurance

A. Responsibility: The supplier of the HVAC digital logic control system shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished by him.

B. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.

C. Tools, Testing and Calibration Equipment: The control system supplier shall provide all tools, testing and calibration equipment necessary to ensure reliability and accuracy of the control system.

5) Reference Standards

A. The latest edition of the following standards and codes in effect and amended as of date of supplier's proposal, and any subsections thereof as applicable, shall govern design and selection of equipment and material supplied:

1. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers

2. ASHRAE BACnet 135-1995-1995

3. UBC Uniform Building Code, including local amendments

4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment

5. NEC National Electrical Code

B. City, county, state, and federal regulations and codes in effect as of date of contract.

C. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

6) Submittals

A. Drawings:

1. Within four weeks after award of contract, the system supplier shall submit review drawings, installation and operation instruction and a recommended spare parts list.

2. Drawings shall be submitted in the following standard sizes: 24 x 36 (ANSI E) or 11 x 17 (ANSI B).

3. Three complete sets (copies) of submittal drawings shall be provided.

4. Drawings shall be available on floppy diskette or CD-ROM media, as specified.

B. System documentation by the vendor shall include the following as a minimum:

1. System configuration diagrams in simplified block format.

2. All input/output Object Type listings, and an alarm point summary listing.

3. For all system elements, (operators terminal(s), global controller(s), logic controllers, routers, repeaters, and converters) provide BACnet 135-1995 Protocol Implementation Conformance Statements (P.I.C.S.).

4. Electrical drawings showing all system internal and external connection points, terminal block layouts and terminal identification.

5. Manufacturer's instructions and drawings for installation, maintenance and operation of all purchased items.

6. Overall system operation and maintenance instructions, including preventive maintenance and troubleshooting instructions.

7. Complete recommended spare parts list.

7) Scheduling and Coordination

A. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases.

B. The schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

8) Warranty

A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from owner acceptance or substantial completion of system demonstration.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

C. This warranty shall apply equally to both hardware and software.

9) Manufacturer

A. Acceptable manufacturer for control system shall be Alerton Technologies, Inc. Other manufacturers may be accepted if they are fully BACnet compliant to the terminal level and if submitted description meets all requirements as outlined in paragraph B. of this section.

B. Alternative BACnet DDC providers such as Automated Logic and Andover will be accepted if prior to bid time they submit a complete proposal, including submittal sheets, and AUTOCAD drawings of proposed system. Drawings shall be specific to proposed project and include all information necessary to install system. Alternative bidders shall also submit a compliance statement (referencing the project specifications) stating paragraph by paragraph that their system meets or does not meet requirements of each paragraph. If the proposed system does not meet requirements of a specific paragraph, bidder's proposal shall explain for each such paragraph how proposed system does not meet those requirements.

C. Owner reserves the right to reject, at his option, any and all bids that do not meet the specified requirements stated.

5. OPERATORS TERMINAL

A. Displays

1. Operators Terminal shall display all data associated with project as called out on drawings and/or object type list supplied. Terminal software shall accept Windows BITMAP (x.bmp) format graphic files for display purposes. Graphic files shall be created utilizing scanned full color photographs of system installation, Autocad drawing files of field installation drawings and wiring diagrams from as-built drawings.

System shall be capable of displaying graphic file, text and dynamic object type data together on each display. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Terminal shall allow user to change all field-resident EMS functions associated with the project such as set points, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.

2. All displays shall be generated and customized in such a manner by the local DDCS supplier that they fit the project as specified. Canned displays shall not be acceptable. Displays shall use standard English (or other specified language) for labeling and readout. Systems requiring factory programming for graphics or DDC logic are specifically prohibited. All graphics and DDC programming shall be supported locally by the installing contractor without factory dependency or assistance.

3. Binary object types shall be displayed as ON/OFF or with customized text. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state bitmap objects on the display screen such that they overlay the system graphic. Each binary object type displayed in this manner shall be assigned up to three bitmap files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the objects commanded status when the bitmap is selected with the system digitizer (mouse). Similarly, allow the terminal operator to

toggle the objects status by selecting (with the mouse) a picture of a switch or light (for example), which then displays a different picture (such as an ON switch or lighted lamp). Additionally, allow binary object types to be displayed as an animated graphic.

Animated graphic object types shall be displayed as a sequence of multiple bitmaps to simulate motion. For example: when a pump is in the OFF condition, display a stationary picture of the pump. When the operator selects the pump picture with the mouse, the represented objects status is toggled and the picture of the pumps impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change bitmap file assignment and also create new and original bitmaps on-line. System shall be supplied with a library of standard bitmaps, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new bitmap objects by the operator (or with third-party software) shall not be allowed (SEE FOLLOWING FOR MINIMUM REQUIREMENTS ON POINTS AND GRAPHICS).

4. Analog Objects shall be displayed with operator modifiable units. Analog Input Objects may also be displayed as individual bitmap items on the display screen as an overlay to the system graphic. Each Analog Input Object may be assigned to a minimum of five bitmap files, each with high/low limits for automatic selection and display of the bitmaps. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog Output Objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the increase or decrease arrow in the analog object spinner box. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value, and accesses various menus where the analog value may be used, such as trendlogs.

5. Analog Objects may also be assigned to an area of a system graphic, where the color of the defined area would change based on the Analog Objects value. As an example, an area of a floor plan graphic served by a single control zone would change color respective to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified on-line, using simple icon tools.

6. A customized menu label (pushbutton) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label pushbuttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A separate display security level may be assigned to each display and system object.

7. A mouse or other form of digitizer shall be used to move pointer arrow to desired item for selection of new display or to allow the operator to make changes to object data.

8. Displays may be modified on site or via remote communications.

9. Display resolution shall be limited by the CRT hardware and Windows software driver only. As a minimum, provide display resolution of 800x600 @256 colors (Super VGA).

10. Entire system shall operate without dependency on the operator's terminal.

B. Security System

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operators terminal functions unless user is logged on. This includes displays as outlined above.

2. Each Operators Terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alpha numeric characters only and are case sensitive (except for User ID). User ID is 0-9 characters, User Name is 0-29 characters, and Password shall be 5 characters. Each system user shall be allowed individual assignment of only those control functions and menu items that user requires access to. All passwords, user names and access assignments shall be adjustable on-line at the operators terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control.

C. Display of Scheduling Object Information

1. Operators terminal display of weekly schedules shall show all information in easy to read 7-day (weekly) format for each schedule. This includes all ON/OFF times (to the minute) for each days events.

2. BACnet Exception (non-normal schedules, such as holidays or special events) schedules shall display all dates that are an exception to the weekly schedules. These specialty schedules shall be displayed at the operators terminal in a format similar to the weekly schedules, again allowing easy data entry. Exception schedule data is entered by the following methods: date entries (one day entries), date-to-date (a range or span of days), and by weeknday (for example, a given day of a given week each month). User shall be able to scroll easily through the months for each year as a minimum.

3. At the operators terminal, the system user shall be able to change all information for a given weekly, or exception schedule if logged on with the appropriate security access.

D. Alarm Indication

1. Operators terminal shall provide audible, visual and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s) being run at the time (such as a word processor). Printout of alarms shall be sent to the assigned terminal and port.

2. Provide log of alarm messages. Alarm log shall be archived to the hard disk of the system terminal. Each entry shall include a description of the event-initiating object generating the alarm; time and date of alarm occurrence; time and date of object state return to normal; and time and date of alarm acknowledgment.

3. Alarm messages shall be in user definable text (English or other specified language) and shall be enterable either at the operators terminal or via remote communication.

E. Trendlog Information

1. System shall periodically gather historically recorded selected samples of object data stored in the field equipment (global controllers, field controllers) and archive the information on the operators terminal (server) hard disk. Archived files shall be appended with new sample data, allowing samples to be accumulated over several years. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operators terminal in a trendlog. Trendlog displays shall be in spreadsheet format. Provide capability for operator to scroll through all trendlog data. System shall automatically open archive files as needed to display archived data when operator scrolls through the data vertically. Display all trendlog information in standard engineering units.

2. System software shall be capable of graphing the trendlogged object data. Software shall be capable of creating x-y (two-axis) graphs that display up to six object types at the same time in different colors. Graphs shall show object type value relative to time.

3. Operator shall be able to change trendlog setup information as well. This includes information to be trendlogged as well as interval at which information is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics point is displayed on.

4. Provide means for operator to directly export to a comma delimited file format, all trendlog data for use in third-party spreadsheet or other database programs. Operation of system shall not be affected by this operation. In other words, the system shall stay completely on-line.

F. Energy Log Information

1. System shall periodically gather energy log data stored in the field equipment and archive the information on the operator terminal's hard disk. Archive files shall be appended with the new data, allowing data to be accumulated over several years. Systems that write over archived data shall not be allowed unless limited file size is specified. System shall automatically open archive files as needed to display archived data when operator scrolls through the data. Display all energy log information in standard engineering units.

2. System software shall be capable of graphing the Energy log data. Software shall be capable of creating graphs in x-y (two-axis) format that show recorded data relative to time. All data shall be stored in comma delimited file format for direct use by third-party spreadsheet or other database programs. Operation of system shall not be affected by this operation. In other words, it shall stay completely on-line.

3. Operator shall be able to change the energy log setup information as well. This includes which meters to be logged, meter pulse value and what type of energy units are being logged. All meters monitored by the system may be logged. All operations shall be password protected.

4. Provide means for operator to export to a comma delimited file format all trendlog data for use by other spreadsheet programs. All data shall be stored such that it may be directly used by third-party spreadsheet or other database programs. Operation of system shall not be affected by this operation. In other words, it shall stay 100% on-line.

G. Configuration/Setup

Provide means for operator to display and change system configuration. This shall include but not be limited to: system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified utilizing easy to understand terminology by means of simple mouse/cursor key movements.

H. Terminal Hardware

Provide operators terminals at locations noted on the plans. Operators terminal shall include the following as a minimum:

*Ethernet card required for on-site system connection.

6. GLOBAL CONTROLLER

A. General

1. Global controller shall provide battery backed real time (hardware) clock functions. It shall also provide system communications to programmable controllers. Global controller shall interface

with Operator terminal(s) for information display. Global controllers shall share information utilizing the BACnet specified Ethernet network.

2. Global controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high speed LAN (Ethernet or ARCnet), MS/TP, and PTP (or modem) ports.

3. Global controller shall be capable of deciding global strategies for the system based on information from any points in the system regardless if the point is directly monitored by the controller. Program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications, are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution shall be a minimum of once per second.

4. Programming shall be object oriented using control program blocks by means of the VisualLogic programming system. Provide documentation in flow chart form for all programming as part of the final system As-Built documentation. Include samples of flow chart documentation in submittals. All flow charts shall be generated with VisualLogic system and automatically downloaded to controller. No reentry of data base shall be necessary.

5. Provide means to view inputs and outputs to each program block in real time as program is executing. This function may be done via the operators terminal, field computer, or via modem.

6. Controller shall have a minimum of 1 Mb battery backed Static RAM, expandable to 3 Mb, along with 128 Kb of EPROM. Battery shall retain static RAM memory and clock functions for a minimum of 1 year. Battery shall be a field replaceable (non-rechargeable) Lithium type.

B. Remote Communications

1. WEB Based interaction through the internet: The control system shall use browser software and an Internet connection to log on to the building automation system. Using the browser the owner shall have the ability to access data displays, operator activity logs, trendlogs, current alarms (view & acknowledge) and alarm history, energy logs, and tenant activity logs. Remote dial up software and software keys shall be provided as backup, but the BMCS shall be accessed via the internet.

Passwords and user profiles shall restrict access only to authorized personnel. The Web based server shall be a self-contained Internet appliance that requires little configuration or setup. Data displays are sourced from the Windows server and converted for a consistent interface.

In addition to the WEB Based Internet interaction, provide all functions that will allow remote communications via modem to off-site locations. Include modem along with all cabling necessary for installation.

2. Provide Windows 95 software for off-site computer which allows operator to view and change all information associated with system on color graphic displays if desired. Operator shall be able to change all parameters in this section from off-site location including all programming of global controllers and programmable terminal unit controllers.

3. Global controller shall have capability to call out alarm conditions automatically if desired. Alarm message and site description shall be sent to off-site computer or serial printer. If desired, controller may also send encoded message to digital pager. All global controllers connected to the local LAN shall be capable of calling out alarm messages through one shared modem connected to one or more of the global controllers on the local LAN.

4. Controller shall have capability to call a minimum of 20 different phone numbers. Numbers called may be controlled by type of alarm, time schedule, holiday schedule or other selectable program parameters.

5. Owner shall provide standard voice grade phone line for remote communication function.

6. Global controller and supplied modem shall be capable of modem-to-modem baud rates of 14.4K baud minimum over standard voice grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require lower baud rates.

C. Schedules

1. Each global controller shall support a minimum of 100 BACnet Schedule Objects and 100 BACnet Calendar Objects.

2. Each schedule object (Weekly or Exception) shall be capable of performing an optimum start. Optimum start calculation shall be based on outside air temperature, zone air temperature deviation from zones daytime heating and cooling set points, and individual zone adaptive heating and cooling coefficients that are adjusted each day based on performance parameters of the individual zone.

D. Logging Capabilities

1. Each Global Controller shall log as a minimum 150 user selectable object types with a minimum of 100 samples per object type with standard memory configuration. Logging shall be expandable, (user defined) with additional memory in global controller. Any object type in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operators terminal. Start of sampling may be by one of the following:

   Selectable log beginning and ending by using BACnet Calendar and Schedule Objects.
   Object type change of value (analog value object)
   Object type change of state (binary value object)

2. Logs may be viewed both on-site or off-site via remote communication.

3. Global controller shall periodically upload trended data to operators terminal for long term archiving if desired.

4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

E. Alarm Generation

1. Object type change of values and change of states may be identified as alarm conditions. When such conditions exist, the global controller identifies each alarm through BACnet Get Alarm Summary Service. This summary of active alarms (Event State property value not equal to NORMAL) is presented to and displayed at the operators terminal for system user action.

   Alarms may be generated within the system for any object type change of value or state either real or calculated. This includes things such as analog object type value changes, binary object type state changes, and various controller communication failure.

2. Each alarm may be dialed out as noted in paragraph B. above.

3. Alarm log shall be provided for viewing of alarms. Log may be viewed on-site at the operators terminal or off-site via remote communications.

F. Demand Limiting

1. System shall monitor energy demand. Energy demand may be from any type of energy source such as electrical or gas. Provide a demand limiting routine which shall shed appropriate system object types to prevent the demand from exceeding preset limits. Demand limiting routine shall be a priority shed type allowing automatic override of specified object type sheds when assigned analog object (temperature sensor) exceeds limits as set by system user at operators terminal. Routine shall be able to change between sets of demand limit and restore setpoints based on BACnet Schedule Objects or system user manual commands at operators terminal.

2. Zone shed method shall be by either preventing zone heating and cooling operations, or by shifting zone heating and cooling setpoints.

3. All parameters of the demand limiting routine shall be modifiable from the operators terminal or via remote communications.

4. Demand limiting function shall be based on loop water temperature.

7. OPERATOR FIELD INTERFACE DEVICE (LANVIEW)

A. Hardware

1. Operator field interface shall communicate to global controller via BACnet MS/TP at all specified speeds from 9600 baud to 76.8K baud.

2. Provide minimum of 128K of nonvolatile RAM for display storage and 32K of EPROM. Battery shall retain memory for 5 years minimum.

3. Operator interface device shall be housed in plastic enclosure suitable for mounting in office area. Device shall be separate unit from global controller and mount on standard double wide box.

B. Displays

1. Operators terminal (Lanview) shall display all data associated with project as called out on drawings and/or object type list supplied, up to the limits of the LANview memory. Information shall be labeled with English description on display and shall be shown in engineering units as labeled (i.e. temperature shall be displayed in degrees F or C.) LANview terminal shall allow user to change all EMS functions associated with the project such as setpoints, weekly & exception schedules, calendar objects (holidays), etc. with single button push. This shall be done without any reference to object type addresses or other numeric/mnemonic indications.

2. All displays shall be generated and customized in such a manner by local DDCS supplier that they fit the project as specified. No canned displays that are modifiable only by factory personnel shall be acceptable. Displays shall use standard English text for labeling and readout.

3. Menu system shall be used for display selection (SEE ATTACHED GRAPHICAL DISPLAY SAMPLES). Menu items on display shall allow penetration to lower level displays. Dynamic point information and menu items may be mixed on the same display to allow sub displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. Display security level may be assigned to each display.

4. All dynamic object type information shall be requested for update every 1 second.

5. Cursor keys shall be used to move cursor to desired item for selection of new display or to allow the operator to make changes. Entry of object name in order to view or change its data, shall not be necessary.

6. Displays may be modified on site at operators terminal, at the LANview terminal, or via remote communications.

C. Security System

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operators terminal functions unless user is logged on. This includes displays as outlined above. Each display shall be capable of being assigned a security level for restricting access.

2. Operator's terminal (LANview) shall access user definable passwords from global controller. Passwords are 4 alphanumeric characters, case sensitive. Each
password may have one of 10 security levels that define extent of access for operator once logged on with that password.

D. Alarms

1. Operators terminal (LANview) shall provide audible (internal buzzer), and visual means of alarm indication.

2. Provide log of alarm messages. Alarm (history) buffer shall be capable of holding up to 180 alarm messages.

8. HYDRONIC HEAT PUMP

A. HEAT PUMP TERMINAL UNIT

1. Each heat pump terminal unit shall be directly controlled by a BACnet compatible dedicated stand-alone unitary direct digital controller (DDC controller). Controller shall be wired to a wall unit (sensor) in its specific controlled zone. Wall unit shall contain precalibrated electronic sensor (1/3 F, (.2 C)) providing controller with current zone temperature status. The controller shall directly control heat pump fan, compressor and reversing valve as required to maintain zone temperature setpoints. Temperature setpoints shall be adjustable at operators terminal. Individual heat pump out-of-normal conditions available at the controller, shall be displayed as alarms at the operators terminal. BACnet Alarms shall be generated by the system LSI (global controller) unit.

2. Sequence

a. OCCUPIED MODE Fan shall run continuously or cycles with compressor. Fan may also be set to run continuously in cooling, but cycle in heating. Operator may select fan operation on a zone by zone basis. Heat pump controller logic shall cycle compressor and reversing valve to maintain heating and cooling setpoints.

b. UNOCCUPIED MODE Cycle fan with compressor to maintain unoccupied space temperature as required for energy conservation.

3. All heat pump control algorithms shall be kept in non-volatile EEPROM at the controller. Controller logic working in conjunction with wall sensor, shall maintain heat pump operation, independent of other control equipment.

4. Standard factory logic control sequences shall be supplied for loading into controller EEPROM. Logic sequences shall be field modifiable to provide any necessary site customizations. Factory control programs shall be proportional plus integral type, maintaining maximum accuracy and stability. Controller shall be programmable, either locally or over the BACnet network. Controller communicates on an MS/TP LAN, utilizing standard BACnet protocol. (See P.I.C.S. below.) Proprietary chip sets, such as LONworks Neuron, shall not be permitted. Gateways that convert standard BACnet communication protocols to proprietary communication systems shall not be permitted.

5. Controller factory logic sequences shall vary the compressor duty time, within an adjustable cycle.

6. Discharge air temperature sensor shall be provided down stream of each heat pump. Sensor shall provide functional, test and alarm monitoring of the heat pump operation.

7. Automatic heat pump alarm shall be displayed at operators terminal if discharge temperature fails to rise above adjustable high limit alarm setpoint(s). Also display alarm at operators terminal if discharge temperature fails to go below adjustable low alarm setpoint(s) when heat pump is cooling. Provide delay time before alarm is generated.

8. Operator shall be able to set a test mode automatically running the heat pump through one heating and one cooling cycle. Out of normal condition(s) shall be displayed at the operators terminal if heat pump operation is unsatisfactory.

9. Provide internal safety timers to allow a minimum ON and OFF time for compressors and fan. Compressor to be on only when fan is ON. Turn off compressor if an operational alarm is detected.

10. Heat pump units with economizer, shall have economizer controlled from the same unitary controller driving the heat pump. Provide minimum setpoints for minimum economizer damper position, and outside air lockout temperature. Provide display at operator terminal for economizer commanded position.

11. Economizer shall never close to less than minimum position when in the occupied mode. It shall close completely if the zone is in unoccupied mode. The economizer shall be used as the first stage of cooling. Economizer shall be driven to minimum position if the outside air temperature goes above the lockout temperature setpoint.

12. Provide condensate out-of-normal condition for each heat pump when condensate pan fills to unacceptable levels. Display condition at operator□s terminal. Operator may select shutdown of cooling only, or entire heat pump. Operator shall have option to set either for each individual zone.

13. System shall monitor hydronic loop water temperature and loop flow. If the water temperature goes above or below adjustable operational limits, or if loop flow is interrupted, all heat pump operation shall be suspended.

14. Status (LED) indication shall be provided on each terminal unit controller for communication activity, and (optionally) for each digital output. It shall be possible by viewing LED to determine if communication status has been established with global controller. It shall also be possible to tell if unit controller is powered. Each digital output currently turned on, will be indicated by its own LED indicator.

15. If unitary controller binary outputs are unused in a specific application, they shall be available to accommodate other system operations, such as control a hydronic water valve at the heat pump.

12. MISCELLANEOUS CONTROLLERS

MISCELLANEOUS FANS/UNIT HEATERS / ENERGY RECOVERY UNITS/ MAU'S

1. Each unit shall be directly controlled and monitored by a BACnet compatible dedicated stand-alone programmable logic unitary direct digital controller (DDC controller). Controller logic system shall interface with time schedule unless points are specified. (See attached points list for minimum requirement on points).

2. Standard factory logic control sequences shall be available for loading into controller EEPROM. Logic sequences shall be field modifiable to provide any necessary site customizations. Factory control programs shall be proportional plus integral type,

maintaining maximum accuracy and stability. Controller shall be programmable, either locally or over the BACnet network. Controller communicates on an MS/TP LAN, utilizing standard BACnet protocol. (See P.I.C.S. below.) Proprietary chip sets for communication shall not be permitted.

3. Provide space temperature sensors in each ventilated room.

4. High temperature alarms shall be generated when operators terminal alarm setpoint is not met.

5. Provide for miscellaneous fans, the following commands/displays at operators terminal:
   a. Manual/auto (scheduled) restroom exhaust fan(s) command(s) and commanded status.
   b. Space CO2 Level Indicator
   c. Space temperature(s).
   d. Space high temperature alarm(s).
   e. Alarm setpoint(s).

6. Standard factory logic control sequences shall be supplied for loading into controller EEPROM. Logic sequences shall be field modifiable to provide any necessary site customizations. Factory control programs shall be proportional plus integral type, maintaining maximum accuracy and stability. Controller shall be programmable, either locally or over the BACnet network. Controller communicates on an MS/TP LAN, utilizing standard BACnet protocol. (See P.I.C.S. below.) Proprietary chip sets, such as ECHELON LONWORKS Neuron, shall not be permitted. Gateways that convert standard BACnet communication protocols to proprietary communication systems shall not be permitted.

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) LOOP WATER CONTROLLER	Time Schedule	Optimum Start	Graphical Display	Setpoint Value	Status Alarm	Trend Logging	Status On/OFF	Alarm Reports	Trend Reports	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
Low Loop Temperature			•	•		•		•	•															
High Loop Temperature			•	•		•		•	•															
Emergency Shutdowdn			•	•		•		•	•															
Outdoor Air Temperature			•			•		•	•	•														
Outdoor Air Temperature Run Pumps Continuous			•			•	•	•	•															
B-1 Supply Temperature			•			•		•	•	•														
B-1 Return Temperature			•			•		•	•	•														
B-2 Supply Temperature			•			•		•	•	•														
B-2 Return Temperature			•			•		•	•	•														
Heat Addition Setpoints				•		•		•	•															
Heat Rejection Stage 1 Setpoint				•		•		•	•															
Heat Rejection Stage 2 Setpoint				•		•		•	•															
Fluid Cooler Damper End Switch																								
Loop Supply Temperature			•			•			•	•														
Loop Return Temperature			•			•			•	•														
Loop Pump-P1			•				•		•							•						•		
Loop Pump-P2			•				•		•							•						•		
Loop Pump-P1 Runhours			•						•															
Loop Pump-P2 Runhours			•						•															
Lead Loop Pump			•						•															
Loop Pump-T1			•				•		•							•						•		
Loop Pump-T2			•				•		•							•						•		
Loop Pump-T1 Runhours			•						•															
Loop Pump-T2 Runhours			•						•															
Date/time			•																					

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) WATER SOURCE HEAT PUMPS	Time Schedule	Optimum Start	Display	Setpoint Value	Status Alarm	Enable/Disable	Status On/OFF	Alarm Log	Trend Log	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
Occupied/Unoccupied	•																							
Warm-up							•		•															
Cooldown							•		•										•					
Afterhours							•		•															
Space Temperature			•						•	•														
Compressor		•				•	•		•													•	•	
Reversing Valve							•		•															•
Fan							•		•													•	•	
Occupied Heating Setpoint			•	•					•															
Occupied Cooling Setpoint			•	•					•															
Unoccupied Heating Setpoint			•	•					•															
Unoccupied Cooling Setpoint			•	•					•															
Current Heating Setpoint			•	•					•															
Current Cooling Setpoint			•	•					•															
Current T'stat Setpoint Adj.				•					•															
Current Demand Offset				•					•															
Fan Operating Mode							•		•															
Disable Unit						•			•															
Disable Compressor						•			•															
Heating Signal %				•					•															
Cooling Signal %				•					•															
Supply Air Temperature				•					•	•														
Return Air Temperature				•					•	•														
Cooling Attained Air Temperature				•					•	•														
Heating Attained Air Temperature				•					•	•														

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) WATER SOURCE HEAT PUMPS - CONTINUED	Time Schedule	Optimum Start	Display	Setpoint Value	Status Alarm	Enable/Disable	Status On/OFF	Alarm Log	Trend Log	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
Water Outlet Temperature			•						•	•														
Water Inlet Temperature				•					•	•														
Supply Voltage %			•						•															
Afterhours Timer Limit			•	•					•															
Alarm Reset			•				•		•															
Heating Temp Fault			•					•	•															
Cooling Temp Fault			•					•	•															
Heating Temp Fault Setpoint			•	•					•															
Cooling Temp Fault Setpoint			•	•					•															
Low Water Temp Setpoint			•	•					•															
High Water Temp Setpoint			•	•					•															
Low Water Temp			•		•			•	•									•						
High Water Temp			•		•			•	•									•						
High Space Setpoint			•	•				•	•															
Low Space Setpoint			•	•				•	•															
Bad Space Temperature Sensor			•		•			•	•									•						
Bad Water Temperature Sensor			•		•			•	•									•						
Brown Out			•		•			•	•									•						
Condensate Overflow			•		•			•	•									•						
Supplemental Electric Heat		•				•	•		•													•	•	
Compressor 1 Low Temp			•		•			•	•									•						
Compressor 1 Low Pressure			•		•			•	•									•						
Compressor 1 High Pressure			•		•			•	•									•						
Compressor 1 Low Shutdown			•		•			•	•									•						

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) WATER SOURCE HEAT PUMPS - CONTINUED	Time Schedule	Optimum Start	Display	Setpoint Value	Status Alarm	Enable/Disable	Status On/OFF	Alarm Log	Trend Log	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
*Compressor 2 Low Temp			•		•			•	•									•						
*Compressor 2 Low Pressure			•		•			•	•									•						
*Compressor 2 High Pressure			•		•			•	•									•						
*Compressor 2 Low Shutdown			•		•			•	•									•						
Date / Time			•																					

* Applies to Dual Compressor Units

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) ROOFTOP WSHP WITH ERV / DEHUMIDIFICATION (NEUTRAL AIR RTU)	Time Schedule	Optimum Start	Display	Setpoint Value	Status Alarm	Enable/Disable	Status On/OFF	Alarm Log	Trend Log	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
Discharge Air Temperature			•	•				•	•	•														
Return Air Temperature			•					•	•	•														
Outdoor Air Temperature			•					•	•	•														
Space Temperature			•	•				•	•	•	•													
Return/Exhaust Fan Speed			•	•				•	•											•				
Outdoor Air Damper Position			•	•				•	•					•						•				
Control Temperature			•	•				•	•															
Stages of Cooling			•	•		•	•	•	•															
Stages of Heat			•	•		•	•	•	•															
Outdoor Air Enthalpy			•				•	•	•															
Cooling Enable Control Status			•			•	•	•	•							•							•	
Mechanical Cooling Control Status			•	•				•	•							•								
Ambient Off Cooling Control Status			•	•				•	•							•								
Network Off Cooling Control Status			•	•				•	•							•								
Manual Off Cooling Control Status			•	•				•	•							•								
Heating Enable Control Status			•	•				•	•							•							•	
Network Off Heating Control Status			•	•				•	•							•								
Manual Off Heating Control Status			•	•				•	•							•								
Airflow Status			•	•				•	•							•								
Water Outlet Temperature			•						•	•														
Water Inlet Temperature				•					•	•														
Supply Fan Status			•	•				•	•							•					•			
Return Fan Status			•	•				•	•							•					•			

INPUT/OUTPUT SUMMARY TABLE

										Inputs										Outputs				
Project Name	Control Program Functions									Analog						Digital				Analog		Digital		
Monitor Control Points (See Drawings for Quantities) ROOFTOP WSHP WITH ERV / DEHUMIDIFICATION (NEUTRAL AIR RTU) – CONTINUED	Time Schedule	Optimum Start	Display	Setpoint Value	Status Alarm	Enable/Disable	Status On/OFF	Alarm Log	Trend Log	Temperature	Humidity	Pressure	Flow	Position	Demand	Status	Filter	Alarm	Override	0-10VDC	4-20ma	Start/Stop	Enable Disable	Open/Close
Cooling Operating Hours			•					•	•															
Dehumidification Operating Hours			•					•	•							•								
Dehumidification Operating Status			•					•	•							•								
Energy Recovery Hours			•					•	•															
Energy Recovery Wheel Status			•					•	•							•								
Outdoor Air Temperature Entering Wheel			•					•	•	•	•													
Outdoor Air Humidity Entering Wheel			•					•	•	•	•													
Outdoor Air Temperature Leaving Wheel			•					•	•	•	•													
Outdoor Air Humidity Leaving Wheel			•					•	•	•	•													
Exhaust Air Temperature Entering Wheel			•					•	•	•	•													
Exhaust Air Humidity Entering Wheel			•					•	•	•	•													
Exhaust Air Temperature Leaving Wheel			•					•	•	•	•													
Exhaust Air Humidity Leaving Wheel			•					•	•	•	•													
Unoccupied Off Unit Status	•	•	•		•		•	•	•							•								
Network Off Unit Status	•	•	•		•		•	•	•							•								
Calibration Unit Status	•	•	•		•		•	•	•							•								
Startup Unit Status	•	•	•		•		•	•	•							•								
Unoccupied Fan Status	•	•	•		•		•	•	•							•								
Unoccupied Discharge Air Status	•	•	•		•		•	•	•							•								
Unoccupied Cooling Status	•	•	•		•		•	•	•							•								
Unoccupied Heating Status	•	•	•		•		•	•	•							•								
Date / Time			•																					

12. SENSORS

A. MICROSET II DIGITAL WALL CONTROLLER(DWC)

1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Controller shall also allow service technician access to hidden functions as described in sequence of operation.

2. The DWC shall simultaneously display room setpoint, room temperature,outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the DWC. Time remaining shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.

4. See sequence of operation for specific operation of DWC displays and function keys in field service mode and in normal occupant mode. Provide digital display wall controllers as specified in point list.

5. Field service mode shall be customizable to fit different applications. If DWC is connected to water source heat pump controller, water source heat pump shall be calibrated and all parameters shall be viewed and set from the DWC.

13. EXECUTION

A. Examination

1) Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

2) Notify the Owners Representative in writing of conditions detrimental to the proper and timely completion of the work.

3) Do not begin work until all unsatisfactory conditions are resolved.

B. Installation (GENERAL)

1) Install in accordance with manufacturer's instructions.

2) Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to insure a complete operating system in accordance with the sequences of operation and point schedules.

C. Location and Installation of Components

1) Locate and install components for easy accessibility; in general, mount 60 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from Owners representative prior to installation.

2) All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

3) Identify all equipment and panels. Provide permanently mounted tags for all panels.

4) Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections; sized to suit pipe diameter without restricting flow.

D. Interlocking and Control Wiring

1) Provide all low voltage interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with Specification Division 16 and all national, state and local electrical codes.

2) Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions.

3) Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's representative prior to rough-in.

4) Provide auxiliary pilot duty relays on motor starters as required for control function.

5) Electrical Contractor to provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

6) All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed in a neat and inconspicuous manner per local code requirements.

E. DDC Object Type Summary

1) Provide all database generation.

2) Displays: System displays shall show all analog and binary object types within the system. They shall be logically laid out for ease of use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

3) Run Time Totalization: At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

4) Trendlog: All binary and analog object types (including zones) shall have the capability to be automatically trended.

5) Alarm: All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

6) Database Save: Provide back-up database for all stand-alone logic controllers on floppy disk.

F. Field Services

1) Prepare and start logic control system under provisions of this section.

2) Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3) Provide the capability for off-site monitoring at Control Contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.

4) Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

G. Training

1) Provide application engineer to instruct owner in operation of systems and equipment.

2) Provide system operators training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of 3 persons.

3) Provide training above as required up to 40 hours as part of this contract.

H. Demonstration

1) Provide systems demonstration under provisions of Section 15010.

2) Demonstrate complete and operating system to Owner's Representative.

3) Provide certificate stating that control system has been tested and adjusted for proper operation.

14. ROUTER, CONVERTER, REPEATER

A. Routing functions shall be performed by global controller using only BACnet standard protocols as defined by ASHRAE SPC-135P. The Converter, interconnects a standard computer serial port with an MS/TP LAN. Repeater functions shall be handled by an device designed to selectively interconnect two or more portions of MS/TP LAN cable.

1. ROUTERS: The global controller shall perform the BACnet definition functions of interconnecting two or more BACnet networks together, forming a BACnet internetwork. The router shall have optional plug-on boards permitting the following BACnet communication methods:

a. The global controller shall have the routing functionality of interconnecting BACnet Ethernet high speed LAN to BACnet MS/TP LAN.

b. The LSI as a router, (rather than global controller) shall have additional capability of interconnecting BACnet Ethernet high speed LAN, to BACnet ARCNET high speed LAN.

c. BACnet PTP (RS-232 point-to-point) communication shall be available on the global controller by including a modem. The PTP/modem option shall operate under the BACnet half router communication protocol.

2. CONVERTER: A converter shall be provided to interface a portable field service computer from its RS-232 (serial) port to the global controller BACnet MS/TP LAN (RS-485).

3. REPEATERS: BACnet repeaters shall provide selective interconnection between two or more segments of MS/TP LAN cable. The repeater shall be an active device, containing logic capable of detecting and repeating signals from one MS/TP LAN cable segment to all other

segments of the cable. Repeaters shall permit additional nodes to be added to the MS/TP LAN, up to a maximum of 256 nodes, per LSI.

15. ELECTRONIC ACTUATOR SPECIFICATION

1. ELECTRONIC VALVE ACTUATORS

a. Actuator shall be fully modulating, floating (tri-state), two position, and/or spring return as indicated in the control sequences. Specified fail safe actuators shall require mechanical spring return.
b. Modulating valves shall be positive positioning, responding to a 2-10VDC or 4-20mA signal. There shall be a visual valve position indicator.
c. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
d. Actuator shall provide minimum torque required for proper valve close-off. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).
e. Actuators shall be UL listed.

2. ELECTRONIC DAMPER ACTUATORS

a. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a V bolt and V shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
b. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
c. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.
d. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
e. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2 point floating type and provide a 2-10VDC actuator position feedback signal.
f. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
g. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
h. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
I. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

2.07 Boiler

A. The Boiler shall be a LOCHINVAR KNIGHT XL Model KN 700-M13 having a modulating input rating of 700M Btu/Hr, an output of 600 M Btu/Hr and shall be operated on (Natural Gas). The Boiler shall be capable of full modulation firing down to 20% of rated input with a turndown ratio of 5:1.

B .The Boiler shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in

the header configuration. The 316L stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a ten (10) year limited warranty. The Boiler shall have a condensate neutralizer kit.

C. The Boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The Boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the ASHRAE 103 Standard. The Boiler shall operate at a minimum 94% thermal efficiency at full fire on 600,000, 700,000 and 800,000 Btu/hr models. All models shall operate up to 98% thermal efficiency with return water temperatures at 100°F or below. The Boiler shall be certified for indoor installation. The Boiler's Thermal Efficiency shall be verified through third party testing by the Hydronics Institute Division of AHRI and listed in the AHRI Certification Directory.

D. The Boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The Boiler shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The Boiler shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column. The Boiler shall be equipped with leveling legs.

E. The Boiler shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The Boiler shall be equipped with a temperature/pressure gauge (field installed); high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (field installed); outlet water temperature sensor; return water temperature sensor; outdoor air sensor, flue temperature sensor; flow switch (field installed).

F. The Boiler shall feature the "Smart System" control with a 2-line, 16 character LCD display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, domestic hot water prioritization and PC port connection. The Boiler shall allow 0-10 VDC input connection for BMS control and have built-in "Cascade" to sequence and rotate while maintaining modulation of up to eight boilers without utilization of an external controller. Supply voltage shall be 120 volt/60 hertz/ single phase.

G. The Boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 28 data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure switches, Tank Thermostat, Wall Thermostat/Zone Control, System Supply Sensor, Outdoor Sensor, Building Management System signal and Cascade control circuit. A high voltage terminal strip shall be provided for Supply voltage. The high voltage terminal strip plus integral relays are provided for independent

pump control of the System pump, the Boiler pump and the Domestic Hot Water pump. The dry pump contacts shall be sized for up to 1.5 hp/120V, 3 hp/240V or 30 amp pumps.

H. The Boiler shall be installed and vented with Direct Vent Vertical system with a vertical roof top termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the BOILER from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the roof top with the manufacturer's specified air inlet cap. The BOILER's total combined air intake length shall not exceed 100 equivalent feet. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. *Foam Core pipe is not an approved material for exhaust piping.*

I. The Boiler shall have an independent laboratory rating for Oxides of Nitrogen (NO_x) of 20 ppm or less corrected to 3% O_2. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

J. The Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

K. The Boiler shall be suitable for use with polypropelene glycol, up to 50% concentration without contingencies.

L. The Firing Control System shall be M13 GE GAP (FM/IRI/CSD-1) (KB 500 – 800).

M. The Boiler shall have low and high gas pressure switches with manual reset.

2.08 Pumps

A. SUMMARY: The entire set of bid documents including plans & specifications applies to this section.

B. QUALITY ASSURANCE: Install pumps in accordance with “Hydraulic Institute Standards.”

C. ACCEPTABLE MANUFACTURERS: Subject to compliance with requirements, provide products from one of the following manufacturers:
1. Bell & Gossett, ITT
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.
4. Approved Equal

D. PUMPS:
1. Refer to data sheet and pump schedule on drawings for type, sizes, capacity, electrical data.
2. Select motors that are non-overloading within the full range of the pump performance curve.
3. Pump impellers shall be statically and dynamically balanced.
4. Apply factory finish paint to assembled, non-stainless steel pumps, and test units prior to shipping.

E. INSTALLATION
1. Examine areas, equipment foundations, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of pumps.
2. Comply with the manufacturer's written installation and alignment instructions.
3. Install pumps in locations and arrange to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
4. Support pumps and piping separately so that the weight of the piping system does not rest on the pump.
5. Set base-mounted pumps on concrete foundations, unless otherwise indicated. Disconnect coupling halves before setting. Do not reconnect couplings until the alignment operations have been completed.
6. Suspend inline pumps using all thread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump independent from the piping system.

F. ALIGNMENT

1. Align pump and motor shafts and piping connections after setting on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.
2. Adjust alignment of pump and motor shafts for angular and parallel alignment by one of the two methods specified in the Hydraulic Institute "Centrifugal Pumps - Instructions for Installation, Operation and Maintenance."
3. After alignment is correct, tighten the foundation bolts evenly, but not too firmly. Fill the base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.
4. Alignment tolerances shall meet manufacturer's recommendations.

2.09 Fluid Cooler

A. Closed Circuit Cooling Tower

1. General: Furnish and install, as shown on the plans, one factory-assembled closed circuit cooling tower of induced draft design with vertical air discharge. Overall dimensions shall not exceed approximately 7'6" x 8'6" , with an overall height not exceeding approximately 13'6". Operating weight shall not exceed 9,500 lbs. The closed circuit cooling tower shall be Baltimore Aircoil Company Model FXV-424-HM.

2. Thermal Capacity: The closed circuit cooling tower shall be warranted by the manufacturer to have capacity to cool 230 USGPM of water from 100°F to 90°F at 78°F entering wet-bulb temperature. Coil pressure drop shall not exceed 3psi. The performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201 or, lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC- 105, by the Cooling Technology Institute, or other qualified independent third party testing agency. Manufacturers' performance guarantees or performance bonds without CTI Certification of water ratings shall not be accepted.

3. Quality Assurance: The cooling tower manufacturer shall have a Management System certified by an accredited registrar as complying with the requirements of ISO-9001:2000 to ensure consistent quality of products and services.

B. Construction Details

1. Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel panels and structural elements shall be constructed from heavy-gauge, G-235 hot-dip galvanized steel, with cut edges given a protective coat of zinc-rich compound.

2. Coil Section: The heat transfer section of the closed circuit cooling tower shall be encased with removable heavy-gauge galvanized steel panels. The coil shall be constructed of continuous serpentine all prime surface steel, be pneumatically tested at 375 psig and be hot-dip galvanized after fabrication. The coil shall be designed for free

drainage of fluid and shall be ASME B31.5 compliant. Maximum allowable working pressure shall be 300 psig.

3. Cold Water Basin: The cold water basin shall be constructed of heavy-gauge hot-dip galvanized steel. The basin shall include a depressed section with drain/ clean-out connection. Standard accessories shall include large area, lift-out steel strainers with perforated openings sized smaller than water distribution nozzle orifices, an integral anti-vortexing hood to prevent air entrainment, waste water bleed line, and brass make-up valve with large diameter plastic float arranged for easy adjustment.

4. Casing Panels: Casing panels shall be constructed of steel matching the structure defined in section 2.1

C. Spray Water System

1. Spray Water Pump(s): The closed circuit cooling tower shall include a close coupled, bronze-fitted centrifugal pump and motor assembly equipped with mechanical seal, mounted in the basin and piped from the suction connection to the water distribution system. The pump motor shall be the totally enclosed fan cooled (TEFC) type suitable for 208 volts, 3 phase, and 60 hertz electrical service. The system shall include a metering valve and bleed line to control the bleed rate from the pump discharge to the overflow connection.

2. Water Distribution System: Water shall be distributed evenly over the coil at a flow rate sufficient to ensure complete wetting of the coil at all times. Large diameter, non-clog, 360° plastic distribution nozzles shall utilize a two stage diffusion pattern to provide overlapping, umbrella spray patterns that create multiple intersection points with adjacent nozzles. The branches and spray nozzles shall be held in place by snap-in rubber grommets, allowing quick removal of individual nozzles or complete branches for cleaning or flushing.

D. Fill and Drift Eliminators

1. Fill and Drift Eliminators: The fill and integral drift eliminators shall be formed from self-extinguishing (perASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The fill shall be manufactured and performance tested by the closed circuit cooling tower manufacturer to provide single source responsibility and assure control of the final product. A separate set of drift eliminators shall be removable in easily handled sections for quick access to the coil. Eliminators shall have a minimum of three changes in air direction.

E. Air Inlet Louvers

1. Air Inlet Louvers: Air inlet louvers shall be wave-formed, fiberglass-reinforced polyester (FRP), spaced to minimize air resistance and prevent water splash-out.

F. Mechanical Equipment

1. Fan: Fan shall be heavy-duty, axial flow, with aluminum alloy blades. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum fan blade tip clearance for maximum fan efficiency. Fan and shaft shall be supported by heavy-duty, self aligning, grease-packed ball bearings with moisture-proof seals and

integral slinger rings, designed for minimum L10 life of 40,000 hours. Fan shall be drive by a one-piece, multi-groove neoprene/polyester belt designed specifically for evaporative cooling service. Fan and motor sheave shall be fabricated from cast aluminum.

2. Fan Motor: Fan motor shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type with 1.15 service factor, designed specifically for evaporative cooling duty on 208 volt/ 60 hertz/ 3 phase electrical service. The motor shall be furnished with special moisture protection on windings, shafts, and bearings. Each motor shall be mounted on an easily adjusted, heavy-duty motor base.

3. Mechanical Equipment Warranty: The fan, fan shaft, sheaves, bearings, mechanical equipment support and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

G. Access

1. Plenum Access: A large, hinged access door shall be provided on each end wall for access to the coil, drift eliminators, and fan plenum section. The water make-up valve, float ball, and suction strainer shall be easily accessible. On single side air inlet units, the access door shall open to an internal walkway.

H. Accessories

1. Basin Heater(s): The cooling tower cold water basin shall be provided with electric heater to prevent freezing in low ambient conditions. The heater shall be selected to maintain 40°F pan water temperatures at 15° F ambient. The heater shall be 4 kW, 208V/ 3 phase/60 Hz electric and shall be provided with low water cutout and thermostat.

2. Heat loss: The unit shall be equipped with a hood and positive closure dampers.

3. Internal Platform: An internal platform shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf live load or 200 pound concentrated load. Other components of the cooling tower, i.e. basin floor and fill/drift eliminators, shall not be considered an internal working surface. Manufacturers that require that these surfaces be used as a working platform shall provide a two-year extended warranty to the Owner to repair any damage to these surfaces caused by routine maintenance.

I. Equipment Controls

1. Enclosed Controls: An enclosed control panel shall be provided for each cell of the evaporative cooling equipment. The panel shall include full voltage, non-reversing (FVNR) fan motor and pump motor starters in a common enclosure. The panel shall be provided with a main a circuit breaker disconnect and a separate circuit breaker for each motor or speed. Fuse protection will not be accepted. Panels containing basin heaters shall have an Earth Leakage Breaker containing ground fault protection. Starters above 25 A shall be NEMA rated. IEC starters will be accepted for motors below 25 A. Panel shall include a 120V/60Hz control power transformer, Hand-Off-Auto switches for each starter or contactor, and pilot lights for each component. Enclosed controls shall be provided in a NEMA 3R enclosure.

Optional enclosed control features: A basin heater contactor with circuit breaker shall be provided.

2.10 Condenser Water Piping

A. All piping in boiler room shall be type L hard copper or schedule 40 black steel pipe. All condenser supply and return outside boiler room shall be schedule 40 PVC with no insulation.

B. All condensate piping shall be schedule 40 PVC plastic with solvent weld fittings. Provide threaded plug cleanouts at maximum 20' centers for complete rodding.

2.11 GLYCOL

A. System shall be filled with 40% "Dowfrost", (no equal) propylene glycol, 60% water.

2.12 FLEXIBLE CONNECTORS

A. 2" and smaller: Inner hose and braided exterior sleeve; Stainless steel for steel piping; Bronze for Copper piping.

B. 3" and larger: Rated working pressure of 125 psig and temperature of 60°F. to 160°F. Three convolute bellows of contour molded, extrusion grade virgin Teflon TFE T62, ASTM D-1457, Type 3, with monel reinforcing rings. Connectors shall be capable of a minimum of 1/4" misalignment. Flanged end connections: Steel for steel piping; Bronze for Copper piping.

C. Acceptable Manufacturers
Resistoflex
Flexonics
Hyspan
Metraflex
Amber Booth

2.13 SPECIAL DUTY VALVES

A. Calibrated Plug Valves

B. Rated working pressure of 125 psig, and temperature of 240°F. Bronze body, plug or ball valve, with calibrated orifice, differential pressure meter connections with integral check valves and seals, integral pointer, and degree of valve

opening calibrated scale. End connections; 2" and smaller, threaded; 2-1/2" and larger, flanged.

C. Acceptable Manufacturers

Flow Fab
Bell & Gossett ITT; Fluid Handling Division
Nibco

2.14 Combined Pressure/Temperature Safety Valves

A. Provide combined pressure/temperature safety valves as indicated on drawings. Valves shall have a permanently mounted tag, indicating manufacturer, model number, and serial number. Valves shall be tested for proper operation, prior to installation, and provided with a certification form indicating conformance to test and to applicable ASME standard.

B. Acceptable Manufacturers

Watts Regulator Company
Spirax Sarco
Bell & Gossett ITT; Fluid Handling Division

2.15 Pressure Safety Valves

A. Provide pressure safety valves as indicated on drawings. Valves shall have a permanently mounted tag, indicating manufacturer, model number, and serial number. Valves shall be tested for proper operation, prior to installation, and provided with a certification form indicating conformance to test and to applicable ASME standard.

B. Acceptable Manufacturers

Kunkle
Consolidated
Conbarco
Spirax Sarco
Spence

2.16 Pressure Reducing Valves

A. Size and operating pressure as indicated on drawings. Diaphragm operated, bronze body valve, stainless steel valve seat, stainless steel/bronze trim, and removable spring cage assembly for disc replacement, or inspection of internals without removing body from piping. Factory-set at operating pressure and capable of field adjustment.

B. Acceptable Manufacturers

Jordan Valve
Watts Regulator Company
Spence Regulators

2.17 Y-Strainers

A. Class 150, cast iron body, grade 18-8 stainless steel screen (20 mesh for 2" and smaller, and manufacturer recommended perforations for 2-1/2" and larger), ball valve, and blow down nipple. End connections: 2" and smaller, threaded; 2-1/2" and larger, flanged.

B. Acceptable Manufacturers

Armstrong
Mueller
Spirax Sarco
Flow Fab

2.18 Automatic Air Vent

A. Non-modulating, float type for automatic venting of air. Rated working pressure of 150 psig, and temperature of 240°F. Cast iron, bronze or brass body, nonferrous internal parts, discharge connection copper tube pig-tail, and 1/2" inlet connection.

B. Acceptable Manufacturers

Hoffman ITT; Fluid Handling Division
Armstrong
Amtrol
Bell & Gossett ITT; Fluid Handling Division
Flow Fab

2.19 Diaphragm-Type Expansion Tanks

A. Capacity, and size as indicated on schedule on Drawings. Rated working pressure of 125 psig, and temperature of 240°F. Constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 1. Welded carbon steel tank, heavy-duty butyl diaphragm, with gauge glass, pressure gauge tap, air charge fitting, and drain fitting. Provide steel legs for vertical tanks, or steel saddle for horizontal tanks.

B. Acceptable Manufacturers

Amtrol
Armstrong
Bell & Gossett ITT; Fluid Handling Division
Flow Fab

2.20 Air Separator

A. Sized for full system flow. Rated working pressure of 125 psig, and temperature of 350°F. Constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 1. Welded black steel, perforated stainless steel air collector tube, tangential inlet and outlet connections, and threaded blowdown connection. Provide blowdown connection with ball valve, and short threaded nipple with cap. End connections: 2" and smaller, threaded; 2-1/2" and larger, flanged.

B. Acceptable Manufacturers

Amtrol
Armstrong
Bell & Gossett ITT; Fluid Handling Division
Flow Fab

2.21 Substitutions

A. all substitutes must be pre-approved by the architect prior to bidding. See Division 1 for substitution process.

PART III - EXECUTION

3.01 Manufacturer's Written Installation Instructions

A. All materials shall be installed as recommended by manufacturer. Nothing in these specifications shall be construed to vary from manufacturer's written installed instructions without written approval from manufacturer.

B. It shall be the responsibility of this Contractor to coordinate with the other trades for clearance, elevations, etc., before the installation of any material. Where conflicts exist the Architect shall be notified before installing material. Changes required in work specified in this Section caused by neglect to do so shall be made at no cost to the Owner.

C. Arrange with Contractors of other trades for installation of built-in items, blocking, and additional necessary supports.

3.02 Heating/Air Conditioning

A. Furnish and install complete and operable system, consisting of dampers, exhaust fans, air distribution ductless heat pump etc.

3.03 Noise and Vibration

A. It is the specific intent of these specifications and design conditions that the system including equipment, piping and other parts, shall be noiseless and free

of vibration as a result of the new installation in the building. It shall be the responsibility of this Contractor to correct these conditions at no cost to the Owner.

3.04 Wiring Diagrams

A. Furnish complete wiring diagrams for all equipment furnished by this Contractor. Submit wiring diagrams to Architect with equipment submittals for approval.

3.05 Electrical Equipment

A. Starters and thermal protective devices not a factory mounted integral part of equipment specified in this Section shall be furnished by this Contractor for installation by the Electrical Contractor.

3.06 Operating Instructions and Maintenance Data.

A. Upon completion and acceptance of the work by the Owner, the Contractor shall provide an experienced Engineer to instruct the Owner's operators in operation of entire installation. Instruction period shall be for a period of one (1) eight-hour working day. Contractor shall provide four(4) sets of 8 1/2" x 11" typed operating and maintenance instructions. Sample maintenance instructions will be provided by Engineer upon request. Contractor shall also include wiring diagrams of all controls in each set of maintenance instructions.

3.07 Clean-up

A. Upon completion of work under this Section, all unnecessary equipment, materials, rubbish, etc., shall be removed from project site and surrounding area leaving site in a safe and cleared condition.

3.08 Cutting, Patching and Piercing

A. Obtain written permission of the Architect before cutting or piercing structural members. If, in the process of the mechanical work, ducts, piping or equipment need to be installed in an area after it has been completed, the area shall be left in the same condition it was originally. Patching and/or refinishing will be determined by the Architect.

3.09 Access

A. Equipment, valves and devices shall be mounted in a manner which provides adequate maintenance, inspection access and work space. Where access is required for adjustment, cleanout, inspection of maintenance and such access is

not otherwise available, access panels shall be furnished and installed. Panels shall be selected by the Architect.

3.10 Building Openings for Admission or Installation of Equipment

A. The Contractor shall ascertain from his examination of the Architectural and Structural Drawing whether any special temporary or permanent openings in the building for the admission or installation of apparatus furnished under this Contract will be necessary and he shall notify the General Contractor accordingly. He shall pay all cost of making such openings in case of failure to give this notification in time for the General Contractor to arrange for same during construction.

END OF SECTION

DIVISION 16000
SECTION 16100
ELECTRICAL

PART I - GENERAL

1.01 Related Documents

A. Provisions of General Requirements, Division 1, are a part of this section.

1.02 This work shall included, but not necessarily be limited to furnishing and installing:

A. Wiring

B. Conductors and Conduit

C. Fused Disconnects.

D. Wiring Devices, Light Fixtures, Lamps, Ballasts, Fuses.

E. Wiring for Equipment Furnish by Others.

F. Grounding

G. Drawings of Record

H. Prior to bidding, all Contractors shall visit the site and become familiar with all existing conditions, which will affect construction procedures and scope of work required as part of this Section.

1.03 Codes and Standards

A. National Fire Protection Association - National Fire Code.

B. National Electrical Code

C. Building Officials and Code Administrators International, Inc.

D. Underwriter's Laboratories

E. National Electric Safety Code

1.04 Shop Drawings shall be submitted to the Architect for approval. The Contractor shall be responsible for quantities and dimensions. The Contractor shall check all shop drawings prior to submission to the Architect.

1.05 The Contractor shall follow the drawings in the layout of his work and shall consult general construction drawings, mechanical drawings and all other drawings for this project to determine all conditions affecting the electrical work. The drawings are not to be scaled and the Contractor shall verify spaces in which the electrical work is to be installed.

1.06 The Contractor shall take measurements and make layouts as required for the proper installation of the work and coordination with all other work on the project.

1.07 Related Work

A. Mechanical Equipment

B. Painting by Painting Contractor

PART II - PRODUCTS

2.01 Wire and Cable

A. Low voltage wire and cable

1. All wire and cable installed under this contract shall be Southwire, Anaconda, Triangle or approved equal, complete with non-fading type color coding system as set forth by National Electric Code. General interior wiring shall have 600 volt insulation, THHN. Wiring in wet and damp locations shall be THWN.
2. Wire shall be soft annealed copper conforming to current requirements of National Electrical Code, and shall be Brown & Sharp (B&S), or American Wire Gauge (AWG) gauges unless specifically indicated on the Drawings. NO ALUMINUM WIRE SHALL BE USED. Wire smaller than #12 gauge shall not be used.

2.02 Connectors

A. Shall be "Scotch Lok" for up to #8 wire and Weaver, or approved equal, split bolt or set screw type connectors for #6 wire and larger.

2.03 Conduit

A. EMT electrical metallic tubing, Republic "Electriunite", National, Triangle.

B. Rigid galvanized conduit, Republic "Galvanite", National, Triangle, with threaded fittings.

C. Flexible metal conduit, "Greenfield".

D. Carlon, or approved equal, Schedule 40 non-metallic conduit and fittings.

E. Metal Clad (Type MC) cable and fittings manufactured by AFC, or approved equal.

2.04 Outlet, Junction and Pull Boxes

A. Outlet boxes shall be galvanized or sherardized, one-piece pressed steel of sectional type or non metallic (Carlon), of size most suitable for the outlet used. Boxes shall be equipped with plaster rings, extension rings, bar hangers and fixture studs as may be required. Junction or pull boxes, either flush or surface mounted, as indicated or required, shall be of adequate sizes to accommodate the conductors installed therein. Junction and pull boxes shall comply with the National Electrical Code as to construction.

2.05 Fuses

A. Power panels and lighting panels are existing.

B. Fuses shall be Bussmann as follows or as noted on Drawings. Fuses on power feeders shall be Fusetron Dual-Element fuses in the 0-60 amp sizes, "FRN" for 250 volts.

2.06 Wall Switches

A. Shall be Leviton #1120 series, or approved equal, 20 amp, 120/277 volt, grounding clip. Single pole or 3-way as indicated in the drawings. Color as selected by Architect.

2.07 Duplex Convenience Outlets

A. Shall be Leviton #5362, or approved equal, 20 amp grounding type. Ground fault receptacles shall be #6898 Series. Side wire only. Color as selected by Architect.

2.08 Special Outlets

A. Shall be by Leviton as required and as shown on drawings, complete with wall plates, same color as duplex receptacles.

2.09 Switch and Receptacle Plates

A. Shall be Leviton #80700 series to match switch, receptacle, or special outlet as required. or approved equal

2.10 Fused Disconnects

A. Shall be Square D, general duty, single throw, externally operated safety switches, fuses and of poles, volts and ampere ratings for the load shown in NEMA-1 or NEMA-3R enclosures, as required.

2.11 Light Fixtures

A. All light fixtures shall be as scheduled on drawings or approved equal. To be considered as equal, fixtures must have equal features, components, quality of construction, and photometrics.

2.12 Substitutions

A. All substitutions must be pre-approved by the architect prior to bidding. See Division 1 for substitution process.

PART III - EXECUTION

3.01 Manufacturer's Written Installation Instructions

A. All materials shall be installed as recommended by manufacturer. Nothing in these specifications shall be construed to vary from manufacturer's written installed instructions without written approval from manufacturer.

B. It shall be the responsibility of this Contractor to coordinate with the other trades for clearance, elevations, etc., before installation of any material. Where conflicts exist the Architect shall be notified before installing material. Changes required in work specified in this section caused by neglect to do so shall be made at no cost to the Owner or Architect.

C. The Contractor shall verify the voltage phase full-load current and exact location of all electrical equipment before rough-in.

D. Arrange with Contractors of other trades for installation of built-in items, blocking, and additional necessary supports.

3.02 Wire and Cable Installation

A. Unless specifically indicated on Drawings, all wire and cable installed in ordinarily dry locations above base slab shall be Type THHN. Unless specifically indicated on Drawings, all wire installed below grade in slab or grade or in areas subjected to possible condensation, moisture, or weather shall be Type THWN.

B. All wiring shall be in conduit, or shall be type MC cable. See "Conduit" below.

C. All wiring shall be continuous between boxes with out any splices in conduit or frame spaces.

D. All 120 volt 20 amp lighting and receptacle circuits requiring more than 100' of conductor (one way) shall be #10 conductors.

3.03 Conduit Installation

A. Conduit for general use concealed inside building as shown on Drawings shall be EMT or type MC cable. All conduit shall be concealed except where approved by Architect.

B. All conduit for installation exposed or exterior to structure, or within concrete construction or as shown on Drawings, shall be rigid galvanized or Schedule 40 PVC as approved by Architect.

C. Conduit smaller than 1/2" shall not be used. Flexible conduit (Greenfield) may be used in short lengths (maximum 6') for fixture connections, motor connections and other special connections as approved by Architect.

D. Conduit shall be concealed in finished spaces, except where noted otherwise on Drawings. All exposed conduit shall be as approved by Architect and shall be installed in a neat and workmanlike manner with conduit runs parallel to building lines.

E. Conduit shall run continuous between outlets, boxes and cabinet, and each conduit run shall have not more than three 90 degree bends between termination points. Conduit shall bend without crimping or flattening to provide a smooth and even turn with bend radius as great as possible, never shorter than that used in corresponding trade elbow. Conduit bends in which interior enamel has flaked will not be permitted.

F. Conduit shall be supported individually by use of bolted metal clamp type hangers at intervals not exceeding 8'-0' with each hanger rigidly attached to building construction. Vertical conduit supports, where required, shall be clamps attached to structure in an approved manner.

G. Conduit ends shall be reamed and all burrs removed prior to installation, and all conduit shall be kept clean and dry during construction by use of caps and plug. Junction or pull boxes shall be installed as required to facilitate ease of wire pulling. Insulating bushings shall be provided on all conduits at points where entering metal enclosures to prevent abrasion and damage to insulation of wire and cable.

H. Type MC cable installed in ceiling plenums shall be supported to prevent contact with T-bar ceilings.

I. All wiring shall be installed in conduit or mc cable.

3.04 Outlet, Junction and Pull Box Installation

A. The size of each box shall be determined by the number of wires and conduits, or size of conduit entering the box, but shall be not less than 3 1/4" octagon or 4" square with ring.

B. All single to four-gang outlet boxes required in unplastered masonry walls shall be 3½" deep solid type with square corners. All plaster and masonry rings or boxes shall be flush or not more than ¼" behind the finished surfaces.

C. All boxes shall be securely anchored to masonry or frame construction.

3.05 Locations of Outlets and Equipment

A. The Contractor shall coordinate his work with that of other trades in order to provide a proper installation of electrical equipment in keeping with the intent of the Drawings and Specifications. Minor changes relative to the location of electrical equipment may be made by Owner's Representative to comply with structural and building requirements as determined in the course of construction.

3.06 Height of Outlets

A. All heights measured from finished floor line to centerline of device.
   1. Receptacle (general) 18" office; 48" maintenance/warehouse area.
   2. Receptacle (special) as noted on Drawings
   3. Wall Switches 4'-0"

3.07 Panel Circuit Directory

A. Provide a typewritten and laminated directory on inside of cabinet door on all panels designating rooms, outlets and equipment served by each branch circuit of the panel.

3.08 Grounding

A. The complete new electrical installation, including metallic boxes and equipment shall be permanently and effectually grounded in accordance with all code requirements, whether or not such connections are specifically shown and/or specified.

B. Every branch and feeder conduit shall contain a green insulated code sized grounding conductor. Care shall be taken to keep the system neutral conductor separate from the equipment ground except at the point of system derivation.

3.09 Cutting and Patching

A. Contractor shall perform all cutting and patching as required for all electrical work inside and outside of building.

B. All conduit penetrations of rated walls will be sealed.

3.10 Wiring of equipment Furnished by Others

A. Electrical Contractor shall do all power wiring except factory prewired equipment.

B. Furnish and install disconnects at all equipment not furnished with disconnect. Coordinate with with HVAC Contractor to ensure all equipment has a properly sized electrical disconnect at the unit.

C. Starters and thermal protective devices not a factory mounted integral part of equipment furnished by Section 15000, shall be furnished by the HVAC Contractor but installed and wired by the Electrical Contractor.

3.11 Lighting Fixture Installation

A. This Contractor shall furnish and install all lighting fixtures and lamps as required. Material, equipment or services necessary to complete the installation of these fixtures, but not specifically mentioned, shall be furnished as though specified. All fixtures and lamps shall be properly cleaned and adjusted after installation. All

adjustable lighting fixtures shall be carefully positioned by this Contractor in the presence of the Architect or his representative.

3.12 Drawings of Record

A. A blueline or blackline copy of Drawing shall be kept at the job site at all times for the sole purpose of recording horizontal and vertical location of all below grade electrical wiring, referenced to permanent visible structures. At completion of job, neatly record all dimensions and submit for approval by Architect.

3.13 Clean Up

A. Upon completion of work under this Section, all unnecessary equipment, materials, rubbish, etc., shall be removed from project site and surrounding area leaving site in a safe and cleared condition.

3.14 Equipment Label Installation

A. Front cover of each panel, fused disconnect, and other electrical equipment shall have a mechanically attached name plate indicating name/number of panel and second nameplate on subpanels indicating "Fed from (panel #)". Panel nameplates shall have 3/4" letters and secondary nameplates shall have 1/2" letters. Seton #818-2, or approved equal, 1/2" x 4".

3.15 Materials and Workmanship

A. Only new, clean and perfect equipment, apparatus, materials and supplies of latest design and manufacture shall be incorporated in the work in order to assure an electrical system of high quality.

B. All materials shall be new, shall bear the Underwriters Label of Approval and shall be installed according to manufacturer's specifications or as directed by the Architect. The Contractor shall assume responsibility for proper installation of materials in the space available.

3.16 Erection of Apparatus

A. All work shall be done under the supervision of the Contractor who shall provide foremen to lay out all work. All work shall be laid out with due regard for proper working clearances about electrical equipment and the space requirements of the other Contractors. The Contractor shall immediately report to the Architect any conflict or difficulties in regard to the installation.

B. Lighting fixtures, motor switches or controllers, switches, boxes panels, and other electrical apparatus shall be set, mounted, positioned, coupled, connected, assembled or otherwise erected or constructed as recommended by the manufacture or designer thereof, unless approved by the Architect for erection in some other manner.

C. Where crowded locations exist and where there is a possibility of conflict between the trades, the Contractor shall coordinate the exact locations of electrical work with the other trades. After consultation and agreement between the trades, the location shall be approved by the Architect before installation of the work.

D. Equipment of a type that requires replacement, servicing, adjusting, or maintenance shall be located to allow easy access and space for removal of internal assemblies if required.

3.17 Cutting, Patching And Piercing

A. Obtain written permission of the Architect before cutting or piercing structural members. If, in the process of the electrical work, circuits or equipment need to be installed in an area after it has been completed, the area shall be left in the same condition it was originally. Patching and/or refinishing will be determined by the Owners Representative. Sleeves through floors and walls to be black iron pipe flush with walls, ceilings or finished floors, sized to accommodate the raceway.

B. Use care in piercing waterproofing. After the part piercing the waterproofing has been set in place, seal opening and make completely watertight.

C. Provide chrome-plated spring-clipped escutcheon plates where exposed pipe passes through finished walls, floors or ceilings. Cover sleeves and entire opening made for the pipe with escutcheon plates. Provide air and watertight conduit openings through floor slabs, masonry walls and continuous partitions. Tightly caulk space between conduit and building materials with non flammable sealant.

3.18 Access

A. Equipment, valves and devices shall be mounted in a manner which provides adequate maintenance, inspection access and work space. Where access is required for adjustment, cleanout, inspection of maintenance and such access is not otherwise available, access panels shall be furnished by Division 16 for installation by the Division 5. Panels shall be selected by the Architect.

3.19 Cleaning of Equipment and Removal of Rubbish

A. All fixtures, panelboards, motors and all other electrical equipment furnished or installed by the Contractor shall be thoroughly cleaned. At the completion of his work, the Contractor shall remove from the buildings and the premises all rubbish and debris resulting from his operations and shall leave all material and equipment furnished by him and the space occupied by them absolutely ready for use.

B. Under no circumstances shall rubbish be allowed to accumulate in the building or on the premises. All dirt and rubbish resulting from the Contractor's work shall be removed by this Division from time to time and as often as directed by the Architect and Owner's representative.

3.20 Painting

A. All items not provided with a corrosion-resistant finish shall be painted. All electrical control equipment, panels and supporting framework shall have a light gray enamel finish which may be the manufacturer's standard gray, if acceptable to the Architect. Where the finish becomes scratched or marred, it shall be touched up or repainted to match the original finish as directed by the Architect. Particular caution shall be exercised so as not to obscure the nameplate data.

B. All painting other than touch-up of factory finishes shall be by Division 9.

3.21 Tests

A. The entire system shall be tested, demonstrated and explained to such personnel as the Architect shall designate. The Contractor will be required to make the following checks and tests with his instruments as required:
   1. The correctness of lighting circuits to be in conformance with branch circuiting shown on the panel covers after construction.
   2. Motors shall be checked for proper direction of rotation and corrected if necessary.
   3. Grounds shall be checked and the resistance to ground shall not be more than 10 Ohms.
   4. This Contractor shall balance phase currents of all distribution panelboards within +/-10 percent variation between average phase currents and measured individual phase currents.

3.22 Guarantee

A. The Contractor shall guarantee by his acceptance of this Contract that all work installed will be free from any and all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified. If, during a period of one year, or as otherwise specified, from date of Certificate of Completion and acceptance of work, any such defect in workmanship, material or performance appears, the Contractor will without cost to the Owner, remedy such defects within a reasonable time as specified in notice from the Architect. In default thereof, the Owner may have work performed and charge the total cost to the Contractor.

3.23 Maintenance Schedule and Operating Instructions

A. After the project is completed, Contractor shall be required to furnish four (4) copies of instruction sheets to the Owner for the proper maintenance of electrical equipment and systems furnished and installed by him.

B. The Contractor shall be required to instruct Owner's operating personnel in the proper operation of electrical systems.

C. Contractor shall turn over to the Owner all spare parts furnished by manufacturer and those specifically called for in the Specifications. All spare parts shall by properly identified as to the catalog number, manufacturer and the equipment for which they are used.

3.24 Manufacturer's Guarantee and Warranty

A. Manufacturer's equipment guarantee shall be obtained for at least one year. When manufacturer's standard guarantee is for a longer period, or if longer period is called for in the Specifications, this period shall apply and such items, if defective, shall be replaced in accordance with the terms written in the manufacturer's specifications.

B. Manufacturer's certificates of warranty shall be provided for all major pieces of equipment and such written certificates shall be turned over to the Owner prior to the final acceptance of the Project.

3.25 Electrical Circuitry for Equipment

A. The electrical circuits, components, and controls for all equipment are selected and sized, based on the equipment specified. If substitutions and/or equivalent equipment are furnished, it shall be the responsibility of all parties concerned,

involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the electrical characteristics and requirements of that furnished to that specified and/or shown. If greater capacity or more materials or labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then it shall be the responsibility of the parties involved in providing the substitute and/or equivalent items of equipment to provide all compensation for additional charges made for the proper rough-in, circuitry and connections for the equipment furnished. No additional charges shall be made to the Base Bid price or to the Owner.

B. Before rough-in of circuitry or connecting to equipment, the Contractor shall verify the electrical characteristics and requirements of the equipment being furnished, and for that specified and shown on drawings.

3.26 Operating Instructions and Maintenance Data.

A. Upon completion and acceptance of the work by the Owner, the Contractor shall provide four(4) sets of 8 1/2" x 11" typed operating and maintenance instructions. Sample maintenance instructions will be provided by Engineer upon request. Contractor shall also include wiring diagrams of all controls in each set of maintenance instructions.

END OF SECTION

DIVISION 16000

SECTION 16200

STRUCTURED CABLING SYSTEM

01 00 00: RELATED DOCUMENTS

A. PROVISIONS OF GENERAL REQUIREMENTS, DIVISION 1, ARE A PART OF THIS SECTION.

01 43 23: CONTRACTOR QUALIFICATIONS

The Contractor shall at a minimum possess the following qualifications:

Be in business a minimum of five (5) years.

Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.

Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

Personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

Must possess current liability insurance certificates.

Contractor must be registered with BICSI and have at least one RCDD on staff.

Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format.

01 43 23: REQUIRED CONTRACTOR TRAINING

The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

Personnel trained and certified in the design of the Siemon Cabling System®.

Personnel trained and certified to install the Siemon Cabling System®.

The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the CI-301 training course or an on-line re-certification class given every two years.

Provide references of the type of installation provide in this specification.

Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus OTDR.

Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

01 71 00: CONTRACTOR RESPONSIBILITY

Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in this request for proposal.

Contractor acknowledges that **MoDOT** will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest of standard care in performing it's obligation as defined in the following Scope of Work.

01 43 13: MANUFACTURER QUALITY & PRODUCT SUBSTITUTIONS

All telecommunications connecting hardware and cable must be made by an ISO 9001 Certified Manufacturer.

All products must meet the technical requirements listed in sections 6-8 for Siemon ZMAX 6A F/UTP Warranty. Any products not meetings these requirements will not be considered.

INDUSTRY REQUIREMENTS

01 42 19: STANDARDS

The following installation, documentation, component and system industry specifications shall be met or exceeded:

- ANSI/TIA/EIA-568-B.1 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements"
- ANSI/TIA/EIA-568-B.2 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair"
- ANSI/TIA/EIA-568-B.3 and addenda
  "Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard"
- ANSI/TIA/EIA-569-B and addenda
  " Commercial Building Standard for Telecommunications Pathways and Spaces"
- ANSI/TIA/EIA-606-A and addenda
  " Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
- ANSI-J-STD-607-A and addenda
  " Commercial Building Grounding and Bonding Requirements for Telecommunications"
- ANSI/TIA/EIA-526-7
  "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
- ANSI/TIA/EIA-526-14A
  "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
- IEC/TR3 61000-5-2 - Ed. 1.0 and amendments
  "Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"
- ISO/IEC 11801:2002 Ed2.0 and amendments
  " Information technology - Generic cabling for customer premises"
- CENELEC EN 50173:2000 and amendments
  " Information Technology - Generic cabling systems"

SCOPE OF WORK

01 11 00: SCOPE OF WORK:

- Dual Cat6 A FUTP (one white, one blue) per drop.
- Data drop locations indicated by floor plan
- Existing TR on mezzanine to cover all drops on mezzanine and under mezzanine.
- New TR next to elevator to cover all drops on main floor except under mezzanine.
- Single data runs of 6A FUTP in yellow to be run for all wireless access points per floor plan.
- Pathway types and location, Siemon RouteIT Solution installed per floor plan layout
- Installation of 12 single mode LC to LC backbone fibers between TR's
- Installation of (2) Siemon VersaPOD Cabinet Systems (one in each TR).
- Installation of 100 pair copper twisted riser cable between TR's for telephone connectivity. Terminated on 6 pin 66 blocks.
- Install 6A MapITG2 Live with server.

HORIZONTAL CABLING - COPPER

In addition to meeting the 500 MHz category 6A specifications outlined in ANSI/TIA/EIA-568-B.2-10, the requirements in this section must also be met for all applicable balanced twisted-pair products as listed below.

27 15 43: OUTLETS

All 500 MHz category 6A information outlets designed for termination of 4-pair balanced twisted-pair category 6A copper cable must possess the following characteristics at the minimum:

- Exceed category 6A component compliance through the frequency range of 1 to 250MHz with usable bandwidth to 500MHz
- Be available in black, white, red, gray, yellow, blue, green, orange, ivory, bright white, light ivory and alpine white
- Universal design allows the same outlet to be mounted in flat or angled orientation.
- Terminates with an ergonomic and easy to use Z-tool to ensure fast and simple terminations.
- Have a lacing module that offers zero-cross termination, which eliminates pair crossing
- Have available termination tool included with each box of 20 outlets
- Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity
- Support industry standards for T568A or T568B wiring options on each individual outlet
- Allow installation from the front or rear of the faceplate, and allow for the jack to pass through the faceplate without re-termination
- Provide color-coded, snap-in icons available for circuit identification
- Allow for a minimum of 5 terminations without signal degradation below standards compliance limits
- Be constructed of high impact, glass reinforced nylon.
- Have, as an option, an outlet, which can be mounted into an IEC 60603-7 compliant opening (keystone)
- Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

Siemon Z-MAX™ 6A Outlet (Part Number Z6A-S(02) White & Z6A-S(06) Blue)

27 15 43: FACEPLATES

All faceplates installed, as part of this specification shall have these minimum features listed below:

- Be applicable to both fiber and copper applications.
- Be available in 1-, 2-, 3-, 4- and 6-port single-gang configurations or 6-, 8- and 12-port double-gang configurations.
- Allow modules to be removed from the front of the faceplate.
- Allow UTP modules to pass through faceplates even after termination.
- Have write on designation labels for circuit identification together with a clear plastic cover.
- Feature easily removable designation label covers which can be removed without use of tools.
- Be available in single-gang and double-gang configurations.
- Have as a minimum the standard colors of black, white, gray, ivory and light ivory.
- Have optional modular furniture adapters available.
- Have Designer style faceplates and mounting frames available
- Have stainless steel versions available with designation label option.
- Have surface mount boxes and standoff rings available for both single and double gang faceplates.
- Be manufactured using UV resistant, high impact thermoplastic to prevent color fading and provide additional durability.
- Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards.

Siemon MAX® Series Faceplates Part Number MX-FP-S02-(xx); xx = color

27 16 19: PATCH CORDS

All 10G 6A modular equipment cords shall conform to the following minimum performance standards:

- Be augmented category 6 component compliant out to 250MHz with operational bandwidth to 500MHz
- Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz
- Utilize Category 7 S/FTP stranded screened cable for optimal transmission performance to eliminate Alien Crosstalk, with a round low smoke zero halogen jacket
- Be backwards compatible with lower performing categories
- Be equipped with identical modular 8-position plugs on both ends, wired straight through with standards compliant wiring
- Have full 360° shield coverage and metal plug housing to provide durability and resistance to damage.
- Have a PCB based plug to enable high levels of performance.
- Have fixed position front contacts to ensure plug quality and consistent mating with outlets.
- Have internal rear contacts to maintain cable pair symmetry to the point of termination.
- Have a boot that features an ultra slim design for high density applications and snag free operation.
- Use modular plugs, which exceed FCC CFR 47 part 68 subpart F and IEC 60603-7 specifications, and have 50 micro-inches minimum of gold plating over nickel contacts
- Have a dual jack construction for excellent alien crosstalk performance.
- Be available in standard lengths of 3, 5, 7, 10, 15 and 20 ft. with custom lengths available upon request
- Have optional colored clips to allow field color coding even when cords are already installed. Available in Black, White, Red, Gray, Yellow, Blue, Green and Orange
- Are available with colored jackets, Black, White, Red, Gray, Yellow, Blue, Green and Orange
- Be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

Siemon 6A F/UTP Modular Cords Part Number MC6A-S(xx)M-(xx)L / 1st xx = length & 2nd xx = color

27 16 19: COPPER TRUNK CABLES

The pre-terminated Z-MAX 6A copper trunk cable shall be assembled using 500MHz 10G 6A information outlets and cable and must possess the following characteristics at the minimum:

- Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz
- Be backwards compatible with lower performing categories
- Utilize high quality 6A F/UTP cable available in CMR, CMP and LSOH jacket materials.
- Be factory terminated and tested with Z-MAX 6A F/UTP panel and/or work area outlets or modular Z-MAX plugs.
- Have each leg labeled for proper outlet orientation
- Have a “straight cut” pattern to the trunk cable ends to create optimal cable orientation and to limit cable crossing.
- Be available in standard lengths of 3m (9ft) to 90m (295ft) with custom lengths available upon request
- Have each cable assembly coded with a unique identification number for administrative purposes.

Siemon Z-MAX™ 6A F/UTP Trunking Cable Assemblies Recommended

27 15 13: CABLE

All Category 6A cable shall conform to the following minimum performance standards, no substitutions from Siemon Copper:

- Have a round cable jacket available in both CMR and CMP options with a nominal cable O.D. of less than or equal to 7.37mm (0.290 in.)

- Have a construction comprised of 4-pairs of 23AWG solid bare copper conductors utilizing a center isolation member to maintain pair geometry for optimal NEXT performance
- Have a Mylar tape surrounding the cable pairs with a drain wire with an aluminum foil tape surrounding the drain wire
- Have a rip cord installed under the jacket for jacket removal
- Be available in both 1000' and 3000' reels
- Be available in white, gray, yellow and blue
- Provide the following 4-connector guaranteed channel performance:

Frequency (MHz)	Insertion Loss (dB/328 ft.)	NEXT Loss (dB)	PS NEXT Loss (dB)	ACR (dB)	PSACR (dB)	ACR-F (dB)	PS ACR-F (dB)	Return Loss (dB)	Propagation Delay (ns)
1.0	2.0	74.3	72.3	72.3	70.3	67.8	64.8	20.0	570.0
4.0	3.8	65.3	63.3	61.5	59.5	55.8	52.8	23.0	552.0
10.0	6.0	59.3	57.3	53.3	51.3	47.8	44.8	25.0	545.0
16.0	7.6	56.2	54.2	48.7	46.7	43.7	40.7	25.0	543.0
20.0	8.5	54.8	52.8	46.3	44.3	41.8	38.8	25.0	542.0
31.25	10.7	51.9	49.9	41.2	39.2	37.9	34.9	23.6	540.0
62.5	15.4	47.4	45.4	32.0	30.0	31.9	28.9	21.5	539.0
100.0	19.8	44.3	42.3	24.5	22.5	27.8	24.8	20.1	538.0
200.0	29.0	39.8	37.8	10.8	8.8	21.8	18.8	18.0	537.0
250.0	32.8	38.3	36.3	5.5	3.5	19.8	16.8	17.3	536.0
300.0	36.4	37.1	35.1	0.7	-1.3	18.3	15.3	16.8	536.0
400.0	43.0	35.3	33.3	-7.7	-9.7	15.8	12.8	15.9	536.0
500.0	48.9	33.8	31.8	-15.1	-17.1	13.8	10.8	15.2	536.0
550.0*	51.8	33.2	31.2	-18.6	-20.6	13.0	10.0	14.9	536.0
625.0*	55.8	32.4	30.4	-23.5	-25.5	11.9	8.9	14.5	535.0
750.0*	62.3	31.2	29.2	-31.1	-33.1	10.3	7.3	14.0	535.0

* Performance for frequencies beyond TIA and ISO requirements are for information only

- Meet the following electrical specifications:

DC Resistance	**<17.0 Ω/100m**
DC Resistance Unbalanced	**5%**
Mutual Capacitance	**5.6 nF/100m**
Capacitance Unbalanced	**<330 pF/100m**
Characteristic Impedance (ohms)	**1 ≤ f ≤ 100: 100 ± 15%** **100 ≤ f ≤ 750: 100 ± 22%**
NVP	**CMP - 72% CMR - 68%**
LCL	**30-10Log(f/100)dB**
Delay Skew (ns)	**≤ 45**

Siemon 10G 6A™ F/UTP Cable Part Number 9A6P4-A5-(xx)-R1A (Plenum)

Siemon 10G 6A ™ F/UTP Cable Part Number 9A6R4-A5-(xx)-R1A (Riser)

- *Yellow = 05 color as (xx)*
- *Blue = 06 color as (xx)*
- *White = 02 color as (xx)*

HORIZONTAL CABLING - FIBER

In addition to meeting the specifications outlined in ANSI/TIA/EIA-568-B.3 and ISO/IEC 11801:2000 Ed2.0, the requirements in this section must also be met for all applicable optical fiber products as listed below.

27 15 43: OUTLETS/ADAPTERS

All optical fiber outlets/adapters shall meet the following characteristics:

- Be provided in options that offer interfaces to ST, SC, LC, MTRJ and FC terminated jumpers and pigtails.
- Provide for a maximum of 6-Duplex ST, 6-Duplex SC, 6-Quad LC, 12-Duplex MTRJ or 4-Duplex FC on a single adapter plate.
- Offer a 3 and 4-Duplex ST to SC adapter.
- Offer a 12, 24 and 72 Strand MTP to MTP pass through adapter plate
- LC, SC and ST universally accept both multimode and singlemode connectors.
- Include Red, Blue, Black and Clear colored icons for port identification
- Be made of high impact flame-retardant thermoplastic.

Siemon Flat Quick-Pack™ Fiber Adapters

27 15 43: CONNECTORS

All optical fiber connectors shall meet the following characteristics:

- Meet the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-10A.
- Be available in simplex and duplex versions.
- Utilize same termination kit available for ST and SC versions with the addition of an LC upgrade kit.
- Have a quick field termination process, which does not require power.
- Have a termination process, which incorporates use of a reliable anaerobic adhesive, which has a high resistance to environmental extremes.
- Utilize a precision Zirconia ceramic ferrule.
- Have jacketed and buffered versions.
- An outer housing color-coded (blue) in accordance with TIA and ISO cabling standards.
- Meet the following performance specifications:

Parameter	Performance (dB)
Insertion Loss (typ)	0.1
Insertion Loss (max)	< 0.2
Durability (500 cycles)	< 0.1
Return Loss (min)	55

Siemon Singlemode LC Connectors Recommended Epoxy Polish or XLR8 Mechanical

27 16 19: PATCH CORDS/PIGTAILS

Fiber equipment cords shall possess the following characteristics:

- Be available in standard lengths of 1, 2, 3 and 5 meters with custom lengths available upon request
- Utilize duplex singlemode fiber cable that is OFNR riser grade and meets the requirements of NEC/NFPA 70 Section 770-51(B)
- Offer a superior connector polish that meets Telcordia and ISO/IEC specifications for end-face geometry (including radius of curvature, apex offset, and spherical undercut)

- Use cable and connectors that are complaint with color coding specifications as listed in ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-598-B
- Utilize precision zirconia ceramic ferrules on connectors
- Have SC-LC hybrid versions available
- Include dust caps on all assemblies
- Be 100% optically tested to meet the following performance specifications:

Parameter	Singlemode
Max. Insertion Loss (dB)	0.40 (0.1 Typical)
Min. Return Loss (dB)	55 (60 Typical)

Siemon XGLO™LC Singlemode Fiber Jumpers Recommended

27 16 19: FIBER TRUNK CABLES

Fiber trunk assemblies shall meet the following minimum characteristics:

- Be available in custom lengths measured in both meters and feet.
- Utilize Singlemode fiber cable that is available in OFNR, OFNP, LSOH and Plenum Interlocking Armored jackets
- Use cable and connectors that are complaint with color coding specifications as listed in ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-598-B
- Be available with a variety of connector styles including LC and SC
- Include dust caps on all assemblies
- Each leg to be to be designated for proper connector orientation.
- Each cable to be coded with a unique identification number for administrative purposes.
- Have trunk assembled with option “pulling-eye” for ease of installation and to protect terminated ends.
- Be available in strand counts of 6, 12, 24, 36, 48, 72, 96 and 144.
- Be 100% optically tested to meet the following performance specifications:

Siemon XGLO® Singlemode Trunking Cable Assembly Recommended

27 15 23: CABLE

In addition to meeting the applicable performance specifications, all optical fiber cable shall be appropriate for the environment in which it is installed.

BACKBONE CABLING

27 15 23: CABLE

SINGLEMODE OPTICAL FIBER CABLE

Singlemode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.

- Have a Yellow colored round lead free cable jacket available in both OFNR and OFNP constructions.
- Shall contain a Rip Cord applied under the cable jacket for easy cable jacket removal
- Shall contain a lightweight Central Strength member located in the middle of the fiber bundles.
- Shall contain both color-coded buffered fibers as well as color-coded buffer tubes.
- Cables shall have length markings in 2 ft. increments
- Fiber will be available in strand counts of 2, 4, 6, 8, 12, 16, 24, 36, 48, 72, 96 and 144.
- Shall meet these minimum performance parameters:

Minimum Performance Parameters for Qualified Cables							
Fiber	Cable Type	Maximum Attenuation (dB/km)		Zero dispersion		Index of Refraction	
		1310 nm	1550 nm	Wavelength (nm)	Slope (nm-km)	1310 nm	1550 nm
Singlemode	Indoor	0.50	0.50	1300-1324	<0.093	1.467	1.468

- Ethernet Applications Supported

Application	Distance (m)
10GBASE-L (1310 nm)	8,000
10GBASE-E (1550 nm)	30,000
10G Fibre Channel (Serial-1310 nm)	10,000
10G Fibre Channel (WDM-1310 nm)	10,000
1000BASE-LX (1300 nm)	5,000
Fibre Channel 266/1062 (1300 nm)	10,000
ATM 52/155/622 (1300 nm)	15,000

- Physical Characteristics:

Mode and Fiber Type	Core Size (Microns)	Cladding Size (Microns)	Coating Size (Microns)	Buffer Size (Microns)	Core Cladding Concentricity (Microns)
Singlemode	8.3 ± 1.0	125 ± 1.0	245 ± 10	900 ± 50	≤ 0.8

Siemon XGLO™ Singlemode Fiber

27 13 00: BACKBONE CABLING

Cables allowed for use in the backbone include: 4-pair 100Ω balanced twisted-pair copper, multi-pair 100Ω balanced twisted-pair copper, hybrid or bundled 100Ω balanced twisted-pair copper, 50/125µm or 62.5/125µm multimode optical fiber, and Singlemode optical fiber cables. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.

27 13 00: INTRABUILDING CABLING

The cable route within a building, connecting closet to closet or closet to the equipment room is referred to as the Intrabuilding Backbone Subsystem. It links the Main Cross-connect (MC) in the equipment room to Intermediate Cross-connects (IC) and Horizontal Cross-connects (HC) in the Telecommunications Rooms (TR).

It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.

EQUIPMENT ROOMS

27 11 19: PATCH PANELS

All Category 6A-termination panels shall facilitate cross-connection and inter-connection using modular patch cords and shall conform to EIA standard, 19-inch relay rack mounting requirements.

- Offered in kit form to include Z-MAX™ Panel outlets.
- Be made of lightweight, high strength steel with durable black finish in 24 & 48 port 1U configurations
- Have panel outlets the easily snap into place and are automatically grounded without additional steps
- Have a quick release lever that allows individual outlets to be easily removed even in tight installations.
- Have port identification numbers on the front of the panel
- Accommodate both 24 & 48 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])
- Come equipped with integrated rear wire management system
- Be provided with high visibility snap-on magnifying label holders that contain paper labels or Z-MAX icons for port identification.

Siemon Z-MAX™ 6A F/UTP Patch Panel Z6AS-PNL-24(x) or Z6AS-PNL-U48(x)

(x) = Kit with connectors as "K" or Empty (no outlets) for use with trunks "E"

27 11 19: CONNECTING BLOCKS

The connecting block shall facilitate cross-connection and/or inter-connection using patch cords.

The 66 blocks shall posses the following characteristics:

- Be made of high-impact, flame-retardant thermoplastic
- Be available in 4x50-pair size to support up to 12 4-pair balanced twisted-pair cables
- Have optional colored, hinged covers for protection and designation available in white, red, gray, yellow, blue, green, violet and orange
- Have mounting features to allow direct wall mounting, bracket mounting or 19" panel mounting via optional frame
- Incorporate fanning strips on each side of block for management of horizontal cabling and cross-connect (jumper) wires as well as providing a labeling surface for circuit identification
- Have available accessories to include: standoff-brackets, organizer rings, clear snap-on covers, designation strips and category 5e modular test adapter
- Have connecting blocks with a minimum of 200 re-terminations without signal degradation below standards compliance limit
- Support wire sizes: solid insulated 22-26 AWG (0.64 mm - 0.40 mm) or solid stripped 18-19 AWG (1.02 – 0.91mm)
- Meet or exceed TIA/EIA and ISO/IEC category 5e component specifications
- Must be Communications Circuit Accessory Listed per Underwriters Laboratories Standard UL 1863
- Must have Certification by the Canadian Standards Association to C22.2 Canadian Telecommunications Standards

Siemon S66 ™ Wiring Blocks

27 11 16: FIBER ENCLOSURES

All interconnect centers, panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

- Not be bigger then one rack mount space and accommodate up to 36 ports for SC, MT-RJ, LC or ST adapter plates or 18 ports for FC.

- Have preloaded adapter plates with ST and SC fiber adapters in 6 and 8-port version, as well as a 12 port version for the SC, MT-RJ and LC adapters.
- Have blank adapter plates for future growth of the fiber infrastructure.
- Have six and eight port fiber adapter plates, which allow for color coding connectors.
- Have fiber adapter plates with snap-in installation and one-finger removal.
- Accommodate hybrid adapter plates for ST-to-SC or SC-to-ST connections.
- Be modular in design with internal fiber managers that provide slack storage to comply with fiber bend radius and the recommended slack storage length.
- Have a snap-on front shield to be used as a labeling surface and to protect jumpers. This shield can also relocate to another position during termination to maintain circuit identification.
- Accommodates a splice tray for mechanical or fusion splices.
- Be available with a drawer mechanism, which allows the panel to slide forward or to the rear, and has defeatable latches to allow removal from the rack or cabinet.
- Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards.

Siemon Fiber Connect Panel FCP3

27 11 16: RACKS

For rack-mounted installations in a telecommunications room the installer shall use a 19 or 23- inch equipment rack as outlined below:

- Have 116.8 mm (4.6 in) by 152 mm (6 in) vertical cable channels as side rails in 2.1 m (7 ft) height.
- Include vertical cable managers mounted on the front of the channels with hinged covers that can handle large quantities of cables and patch cords. Cable managers must retain cables even when covers are removed. Covers are modular in design, which eliminates the need to remove full-length covers for each patch cord change.
- Have available additional vertical cable manager segments for mounting to the back of the Rack to provide additional cable management.
- Have channels capable of utilizing and re-locating ten high capacity, reusable hook and loop cable managers available in bags of ten.
- Have cable access holes on side rails, which allow cables to be routed between adjacent racks.
- Have standard 19-inch CEA-310-E mounting holes having a full 45 RMS on front and back of rails.
- Have ladder channel, which acts as a top bracket to easily nest a standard 304.8 mm (12 in) ladder tray. The channel must have carriage bolt holes for attaching to the ladder system.
- Have available an optional rack top cable tray which manages cable bundles routed above the rack, and eliminates the need for installing a ladder rack for routing cables. The tray is mounted without the need of tools or hardware and includes up to three (3) separate cable paths featuring removable quarter-turn hook and loop cable managers.
- Be available in two versions, either aluminum or steel with a black finish and utilize black grommets for unused cable openings.
- Have the mounting option of two additional vertical cable management channels 152 mm (6 in) x 2.1 m (7 ft) and 76 mm (3 in) x 2.1 m (7 ft) which can be located between racks. The channel shall include cable retainers, which can be hinged left or right and be located in any position along the channel.
- Have floor mounting holes and a ground lug for 0-6 gauge ground cable provided.
- Have optional 10-outlet (4 ft) power strip for mounting onto the rack.

Siemon RS3 Series Rack System Part Number RS3-07-S

27 11 16: CABINET OPTION

For cabinet enclosure installations in a telecommunications room or data center the installer shall have these minimum features listed below:

- Have overall dimensions of 1000mm (40”) deep by 760mm (30”) wide and 2130mm (84”) tall.
- Be available with fully perforated front and rear doors to maximize air flow efficiency.
- Both front and rear doors must have the ability to open from the left and right without the need for any field modifications or tools.
- Cabinet to be designed with structural corner posts recessed back from both front/rear and sides.
- Have standard CEA-310E mounting holes having a full 45 RMS.
- Both front and rear doors available in split door option with same left and right opening feature.
- When “bayed” together, the cabinets shall create a 7” space between cabinets that can be used for the installation of a variety of vertical cable management and vertical (Zero U) patch panels.
- Be constructed of steel with a total static load capacity of 1000kg (2200lbs).
- Have a top lid that offers multiple cable entry points as well as features for the installation of a ventilation fans, blank panels and cable entry brush guards.
- Have an open access floor enabling maximum airflow as well as cable routing.
- Offer a full variety of internal cable management accessories.
- Offer a full variety of integrated vertical patch panels that offer solutions for UTP, F/UTP, Fiber and Power distribution.

Siemon VersaPOD™ Cabinet System

27 11 16: VERTICAL PATCH PANELS (VPP)

When the cabinets are deployed the vertical patch panel (Zero-U) solution shall have these minimum features:

- Be designed to install within the vertical space created by bayed VersaPOD™ cabinets.
- Be modular in design to offer maximum flexibility of cabling options.
- Hall ports pre-numbered for better port identification
- Have integrated slide features that allow for access to the rear of the VPP’s after installation into the cabinets.
- Offer options for Copper, Fiber and Power Distribution within the VPP’s.
- Have an integrated handle for ease of operation.
- Be constructed of steel.
- Offer optional cable management fingers and doors for added cable support and protection

Siemon VersaPOD™ VPP’s

27 11 16: VERTICAL PATCH CHANNELS (VPC)

When the cabinets are deployed the vertical patch channel solution shall have these minimum features:

- Be designed to install within the vertical space created by bayed VersaPOD™ cabinets.
- Be modular in design to offer maximum flexibility of cabling options.
- Have cable management fingers and door cover included
- Have “pass-thru” holes for ease of access to both the front and rear of the cabinet.
- Have ¼ turn punch outs to accept a variety of ¼ turn cable managers.
- Be constructed of steel.

Siemon VersaPOD™ VPC

27 11 16: CABINET ACCESSORIES

When the cabinets are deployed there are many accessory

items available. Use this section to select and insert those accessories required.

- Be designed to mount in a standard CEA 310E 19” mounting rail.
- Be constructed of 100% copper material.
- Should include (2) pre-terminated #6 AWG Green insulated cables to allow for connection to the rooms grounding system
- Should include hardware and provisions for (17) ANSI 607-A compliant bonding points.
- Should include all mounting hardware.

Siemon VersaPOD™ Grounding Kit

- Be designed to fit into the large opening located on the top of the VersaPOD™ Cabinet.
- Be designed with (3) quiet fan motors for maximum air flow efficiency.
- Should include all mounting hardware as well as electrical service cord.
- Be black in color to match the overall finish of the cabinet.

Siemon VersaPOD™ Fan Kit

- Be designed to allow two or more VersaPOD™ Cabinets to be bayed together.
- Should include all mounting hardware.
- Should be black in color to match the finish of the cabinet.

Siemon VersaPOD™ Baying Kit

ACTIVE EQUIPMENT

27 20 00: DATA COMMUNICATIONS

- Each MCP & DCP should monitor up to 2880 ports and utilize one rack mount space.
- When MCP & DCP are combined, should be able to manage up to 65,000 ports
- Have redundant power and communication ports for each patch panel.
- Accommodate at least 24 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])
- Have rear protective strain relief caps which can be installed onto cable before or after termination

- Allow RJ45 interface for connection of Control Bus Cable connections (to G2 Smart Panels and Smart Enclosures)
- Support industry standards for T568A or T568B wiring options on each individual outlet
- Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro-inches of gold plating over nickel contacts
- Have individual port identification numbers permanently marked on both the front and rear of the panel
- MCP should continuously monitor all components in the system and report issues to the management software.
- Feature on-panel intelligence and a combination of LEDs and a backlight graphic LCD to guide technicians
- Must be certified by Underwriters Laboratories to UL 60950-1, 1st Edition (2003) – Information Technology Equipment. ACA TS 001, A/NZS 3260

Siemon MapIT™G2 Master and Distribution Control Panels Part Number M-MCP

- Have port monitoring capabilities built into each patch panel for increased density.
- Have redundant power and communication ports for each patch panel.
- Be made of black painted Steel, in a 24 port configuration
- Accommodate at least 24 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])
- Feature the Z-MAX™ keystone outlet available in 6A UTP and 6A F/UTP as well as the Cat 6 UTP Max keystone module.
- Allow tool-less termination of keystone outlets
- Feature robust "intellitab" sensor pads constructed with 30 micro-inches of gold over nickel.
- Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity
- Have rear protective strain relief caps which can be installed onto cable before or after termination
- Allow 110 style punch-down termination or modular S110P4 Plug for connection of Control Bus Cable connections (to analyzer)
- Support industry standards for T568A or T568B wiring options on each individual outlet
- Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro-inches of gold plating over nickel contacts
- Have individual port identification numbers permanently marked on both the front and rear of the panel
- Feature on-panel intelligence and a combination of LEDs and a backlight graphic LCD to guide technicians
- Active circuit board on panel must be field serviceable (i.e., allow for replacement without removal of the panel, keystone outlets or patch cords)
- Must be certified by Underwriters Laboratories to UL 60950-1, 1st Edition (2003) – Information Technology Equipment. ACA TS 001, A/NZS 3260

Siemon MapIT™G2 Smart Patch Panel Part Number M-SPP-K24E : 24port Modular Panel, Requires Z6A-SK01 connectors

Siemon MapIT™G2 Patch Cords Part Number M-10GMCS-(xx)M(xx)L / 1st (xx) = length & 2nd (xx) = color

Requires for active equipment terminations to M-SPP; IC6 Patch cords in Live Version

25 13 00: ANALYZERS/SCANNERS

The analyzer/scanners are hardware devices that provide the connection to and real-time monitoring of the "enabled" port connections. The analyzers/scanners shall be user configurable to adapt to any user environment and shall be able to interface at any point with the corporate IP network to consolidate patching/port status into the database.

The design topology shall be flexible enough to adapt to the available space in the racks or cabinets provided and scalable to cater for future growth. Analyzers/scanners shall be mountable in a standard 19" rack. The analyzer/scanner shall have but not limited to:

- 240v mains power
- LED's indicating power status, transmitting, receiving and so forth.
- LAN port
- Serial port
- Reset buttons
- Monitored port I/O's

The analyzer/scanner shall be flexible in terms of port density and be suitable (economically viable) for supporting outlying branch environments accommodating <20 users whilst being scalable enough to support as many ports possible in situations where space and power requirements are at a premium. Systems Integrators should state the port granularity and space/power requirements for the proposed solution.

Patch zones (intra-patching areas) are limited to accommodate a maximum patch-cord length of 10m and are therefore restricted to approximately 4,000 ports but System Integrators should state the maximum patch zone capacity supported by the selected solution.

Each analyzer shall have its own unique IP address unless otherwise specified, and shall communicate with the software via the Ethernet LAN/WAN. In the event that network connection is down or there is a power outage, analyzer shall be able to automatically resynchronize itself with the database upon re-establishment of the network. The analyzer shall be non-intrusive to the prevailing network in the event of any analyzer being faulty or requiring removal from the network.

Systems Integrators should state the selected system support for non-LAN auxiliary devices. The ability to monitor and control (input and output) additional devices - e.g. doors, alarm trips, I/O controllers, thermostatic controls and air conditioning is highly valued as these features complement the existing BMS (building management system).

27 22 19: SERVER/CLIENTS

The system shall be installed on a dedicated server located in the ER. The specification of the server is as follows:

- Memory – 512MByte
- Processor – Pentium III, 800 MHz+
- Graphics – 1280 x 1024 x 64k
- Free Disk Space – 1 Gigabyte
- Operating System – Windows XP or Windows 2000
- Software – Internet Explorer 5.0+

The specification for client workstations is as follows:

- Memory – 256MByte
- Processor – Pentium III, 500 MHz+
- Graphics – 1280 x 1024 x 64k
- Free Disk Space – 1 Gigabyte
- Operating System – Window XP or Windows 2000
- Software – Internet Explorer 5.0+

27 25 33: MANAGEMENT SOFTWARE

- **Scalability**

The solution shall run on a 32-bit architecture operating system, Windows XP/2000 or above and shall be deployed utilizing client server technology optimized for mission critical networks supporting multiple users accessing the database server. The system shall support multi-threading applications and shall include a fully relational transaction-processing SQL engine for database management purpose.

The solution shall support multiple concurrent users, either within a single building or different buildings distributed geographically. The system shall be able to be administrated via the LAN or the WAN. The software must be user-friendly and require minimum supervision once the initial database construction is complete. Upon user-defined searches, reports, events and/or alarms, the system shall inform/alert the system administrator the structure and status of the network infrastructure.

Although initially American English is acceptable, future migration of system technology to additional non-English speaking language support maybe required. Systems Integrators are requested to state the level of language support offered by the proposed solution.

Systems Integrators should attempt to quantify the 'real-time' performance of the proposed system. Speed of notification of events and updates as well as management of critical resources and connections must be notified and controlled in a deterministic manner in real-time. Preference will be given to faster/more reliable solutions as it is envisaged that there is a significant cost of downtime associated with a solution that does not support real-time alerts.

Functionality

System Architecture

The network connection used to link the server and the analyzer/scanner shall be a non-proprietary open system protocol such as TCP/IP or SNMP. System shall also support other industry standard network protocol such as ARP, HTTP, ICMP, Telnet, UDP and TFTP. Under management levels, the system shall also be able to provide serial/telnet login, HTTP and SNMP (read only).

Operational Support & Readiness

The chosen system must support a standard web browser based GUI with additional support for thin client technology (MS Pocket PC).

To enhance operational effectiveness data entry and system configuration activity tools should be made available via the most efficient methodology possible. To aid this process please state the scope, availability and flexibility of any configuration wizards present. In addition the system must be able to support automatic self-discovery at start-up.

The solution shall be capable of storing files containing time stamped information in the form of a historical log that contains a complete record of adds, moves and changes that can be sorted, filtered, and reported. This historical information should be available when interrogating individual ports in order to provide accurate timely roll back information.

Multi select drag and drop capability should be available to all functions particularly when viewing connectivity data and subsequently during the creation of work orders.

Operational Assurance

The system shall underpin the clients existing fault-finding process. The fault-finding capability shall consist of notification, isolation and rectification. Handling these processes efficiently is a function of the level of integration between the clients' management systems. The solution will form the platform upon which a best practice fault management process can be developed. Systems Integrators should outline how the solution accommodates the notification, isolation and rectification of faults.

A basic operational requirement of the solution is the ability to monitor real-time events occurring on the network e.g. the loss of a mission critical connection. The ability to create a warning or an alarm based upon

these unauthorized or unexpected events is of paramount importance. The solution shall exhibit the ability to support a wide range of alarms including but not limited to; taking a photograph, launching any 3rd party application, creating an email, audible alarms, SMS and pager messages.

In addition to reducing fault finding time the solution shall also ensure that down-time due to poorly executed moves, adds & changes is eradicated. The ability to identify and manage authorized and unauthorized actions for entry into the database and for further manager-authorization and storage respectively, is a highly valued feature of the solution. This requirement applies to patching, MAC addresses and switch ports moves adds & changes. In addition the solution must be able to automatically detect changes made during power outages.

Asset Management

The system should also be capable of self-discovering the physical location of network devices (PC's, switches and both PBX & IP phones) as part of an entirely automated process. By correlating end-device information found in switches, PBX's and ARP cache's across the network, with its connectivity database, the system should keep a real-time model of the entire physical network infrastructure (including support for VLAN's). If the connected device has an SNMP agent it shall also be able to discover other SNMP MIB information.

The system should also be capable of detecting network devices being connected and disconnected from the network and automatically update the database accordingly and shall keep an audit trial of all MAC address and select SNMP information changes detected at the wall outlet. The system shall also be able to set "aging" parameters that will aid reclamation of unutilized network devices.

The protocol deployed for the discovery of network device shall be Simple Network Management Protocol (SNMP).

Fulfillment

Within the database a primary requirement is the solutions ability to search and filter information into a variety of formats suitable for reports or screen viewing. Both the speed (single search rather than multiple searches) with which this can be done and the degree of flexibility (being able to reference data from external databases) are the dimensions for enhancing user productivity and are hence a pre-requisite for the chosen software and equipment.

The system must have the ability to enhance the search process by filtering (e.g. to be able to search for all MAC addresses and subsequently filter for only those addresses on a particular floor). The construction and filtering of searches within the system should not be limited.

The ability to present data in a single report must build upon the system search capability as the client wishes to carry out comparisons automatically using data from several sources located both internally within the IT department and externally with facilities management. The system must also support the viewing of this information in a suitable format e.g. the ability to show data associated with an object within a CAD graphics module. If any limitations are present with respect to the capability of the system to perform 100% user definable filtered searches, reports and screen viewing, these must be highlighted by the Systems Integrator.

Another primary function is to support the tracing of circuits. The system shall provide the graphical representation of end-to-end physical connectivity and connection status in real time.

The selected solution must excel at planning and implementing individual and large scale moves, adds & changes. Systems integrators should state how effectively, efficiently and intuitively the simple addition of a new device or the relocation of a workstation are accommodated. The fewer the number of operator actions/time taken to create an accurate work order the better operational efficiency will be. Systems Integrators should state how well the automated MAC process be scaled, whilst retaining the operator simplicity requirements highlighted above. In addition Systems Integrators should state how well the pre-project planning phase is accommodated within the system.

The system shall support the use of CAD graphics located both internally to the application and those located within a 3rd party facilities management database. The CAD function must allow the client to connect the logical and trace information with the physical floor location. The CAD file should be completely customizable and display any dictionary information contained elsewhere within the system or 3rd party databases, such as SNMP information, that maybe pertinent to a particular desktop or user under scrutiny.

The system should import and export CAD files supporting both the latest AutoCAD file formats (.DWG and .DXF)

The system shall support the graphical representation of the racks and cabinets contained within the ER and TR's. This must provide the client with visual information on port connectivity, capacity and utilization. It is envisaged that this feature will save the cost of adding infrastructure when it is not required and prevent the need to carry out physical audits prior to work being undertaken. Systems Integrators should state the capability of the proposed solution to support this requirement and indicate any additional benefits such as the automatic calculation of patch cord length etc.

Security

The system shall provide account level security that includes support for definable access rights. The clients administration team requires the ability to define access for specific types of users i.e. managers, engineers and administrators and assign various levels of security.

The use of encryption to store sensitive data such as passwords, personal information, asset values etc, is desired to secure the data from unauthorized access.

Whilst not a pre-requisite, any features that may enhance the clients existing security policy should be disclosed. For example the ability to identify and locate the addition of unauthorized MAC addresses on the network and the initiation of remedial action would be a desirable feature.

SYSTEM DESIGN REQUIREMENTS

27 15 00: HORIZONTAL CABLING

The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Horizontal Subsystem.

27 11 00: TELECOMMUNICATIONS ROOM

- The Telecommunications Room is generally considered to be a floor serving facility. The Horizontal Cross-connect links the Horizontal Subsystem and the Backbone Subsystem together.
- The Horizontal Cross-connect shall consist of rack or wall mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect centers or fiber management panels/trays for the termination of optical fibers.
- Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.
- The telecommunications room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-B and local codes.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.
- The telecommunications room shall be dedicated to the telecommunications function. Access to telecommunications rooms shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the telecommunications systems or be used for building maintenance services.
- Lighting in the telecommunications room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination. Light switch should be easily accessible when entering the room.
- A minimum of two dedicated duplex or two dedicated simplex electrical outlet, each on a separate circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

27 11 00: EQUIPMENT ROOM

- The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications room and the transmission media required to terminate this equipment on distribution hardware.
- The equipment room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be as specified in the Telecommunication Room section of this specification.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.
- The equipment room shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.
- Lighting in the equipment room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.
- A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

27 11 00: ENTRANCE FACILITY

- The entrance facility shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be as specified ANSI/TIA/EIA-569-B.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.
- The entrance facility shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.
- The entrance facility shall be located in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.
- Lighting in the entrance facility should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.
- A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

INSTALLATION

02 22 00: SITE SURVEY

Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

27 05 28.29: CABLE PATHWAYS

- Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
- Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations.
- Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
- Pathways shall not be located in elevator shafts.

27 05 28.33: INTRABUILDING CABLE ROUTING

- The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single story building like a school or factory.
- Unless otherwise recommended by the manufacturer, all fiber cables will be run in innerduct.
- Fibers will be terminated in the telecommunications rooms using SC, ST, MT-RJ, or LC connectors in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary.
- The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect. This is known as a hierarchical star topology.
- At least one 4-pair balanced twisted-pair, hybrid/bundled or multi-pair cable should be run for each Intrabuilding backbone segment.
- Optical fiber should be run for any backbone segment greater than 90 m (295 ft.). If the Intrabuilding backbone segment is less than 90 m (295 ft), and fiber is not routed, the balanced twisted-pair cable shall be category 5e or higher.
- Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.

27 15 00: HORIZONTAL CABLE ROUTING

- All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
- The combined length of jumpers, or patch cords and equipment cables in the telecommunications room and the work area should not exceed 10 m (33 ft) unless used in conjunction with a multi-user telecommunications outlet.
- Two horizontal cables shall be routed to each work area. At least one horizontal cable connected to an information outlet shall be 4-pair, 100 Ω balanced twisted-pair.
- It is recommended that a minimum horizontal cable distance of 15 m (49 ft.) shall be maintained between the telecommunications room and the work area.
- For installations with consolidation points, a minimum horizontal cable distance of 15 m (49 ft) shall be maintained between the telecommunications room and consolidation point, and 5 m (16 ft) between the consolidation point and the work area.
- Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.

- In open ceiling cabling, cable supports shall be provided by means that is structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.5 m (5 ft) apart. **NOTE**: *Cable tie-downs should maintain a minimum distance of 0.6 m (2 ft) apart when within 5 m (16 ft) of the termination point*.
- **F/UTP (ScTP) ONLY**: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than 3kVA, shall be installed with a minimum clearance of 0 m (0 ft).
- **F/UTP (ScTP) ONLY**: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 3kVA but less than 6kVA, shall be installed with a minimum clearance of 0.6 m (2 ft).
- **F/UTP (ScTP) ONLY**: Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 6kVA, shall be installed with a minimum clearance of 1 m (3 ft).
- No telecommunications cross-connects shall be physically located within 6 m (20 ft) of electrical distribution panels, step down devices, or transformers, which carry voltages in excess of 480 Vrms.
- For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
- The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
- Each run of balanced twisted-pair cable between horizontal portion of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.
- In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.
- Continuous conduit runs installed by the contractor should not exceed 30.5 m (100 ft) or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.
- All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.
- The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not cause a geometric shape of the cables. Under no circumstances should cables in the horizontal pathway be bundled. This is to minimize “alien” cross talk.
- Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill is limited to 60% fill for move and changes.
- Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

27 15 43: WORK AREA TERMINATION

- All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
- The telecommunications outlet/connector shall be securely mounted at planned locations.
- The height of the telecommunications faceplates shall be to applicable codes and regulations.

PULLING TENSION

- The maximum cable pulling tensions shall not exceed 25lbf (max).

BEND RADIUS

- The maximum cable bend radii shall not exceed manufacturer’s specifications.
- In spaces with balanced twisted-pair cable terminations, the maximum bend radius for the 4 pair cable shall not exceed four times the outside diameter of the cable. This shall be done unless this violates manufacturer specifications.
- During the actual installation, bend radius on 4 pair cable shall not exceed eight times the outside diameter of the cable. This shall be done unless this violates manufacturer specifications.

SLACK

- In the work area, a minimum of 300 mm (12 in) should be left for balanced twisted-pair cables, while 1 m (3 ft) be left for fiber cables.

- In telecommunications rooms a minimum of 3 m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

27 11 23: CABLE TIE WRAPS

- Tie wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath. **NOTE**: Tie wraps shall not be used on patchcords/equipment cords.
- Hook and loop cable managers should be used in the closet where reconfiguration of cables and terminations may be frequent.

Siemon Company VCM Series Recommended

27 05 26: GROUNDING

- All grounding / earthing and bonding shall be done to applicable codes and regulations.

07 84 00: FIRE PROTECTION

- Properly installed firestop systems shall be installed to prevent or retard the spread of fire, smoke, water, and gases through the building. This requirement applies to openings designed for telecommunications use that may or may not be penetrated by cables, wires, or raceways.
- Fire stops shall be done to applicable code.

01 71 00: WORKMANSHIP

- All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
- All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.
- Workers must clean any debris and trash at the close of each workday.

TESTING

Testing of all newly installed cable channels shall be performed prior to system cutover.

01 33 19: COPPER TESTING

- All 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device.

- All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified by the table below:

Performance Guarantees for Z-MAX 6A F/UTP Channels												
Parameter	Frequency (MHz)											Guaranteed Margin[1] (1-500 MHz)
	1	4	10	20	62.5	100	200	250	300	400	500	
Insertion Loss	2.2	4.0	6.3	8.9	15.9	20.3	29.2	32.9	36.2	42.3	47.8	3%
Return Loss	22.0	22.0	22.0	20.5	17.0	15.0	12.0	11.0	10.2	9.0	9.0	3.0
NEXT	68.0	66.0	59.6	54.6	46.4	42.9	37.8	36.1	34.7	32.6	30.9	3.0
PS NEXT	65.5	64.0	57.5	52.5	44.1	40.6	35.4	33.7	32.3	30.1	28.3	3.5
ACR-N	67.0	64.9	56.1	48.5	33.0	25.0	10.7	5.2	0.4	-8.1	-15.4	6.0
PS ACR-N	64.5	62.9	54.0	46.3	30.7	22.7	8.3	2.8	-2.1	-10.6	-18.0	6.5
ACR-F	70.3	58.2	50.3	44.2	34.3	30.3	24.2	22.3	20.7	18.2	16.3	7.0
PS ACR-F	70.3	58.2	50.3	44.2	34.3	30.3	24.2	22.3	20.7	18.2	16.3	10.0
PS ANEXT	77.0	77.0	77.0	77.0	73.0	70.0	65.5	64.0	62.8	61.0	59.5	10.0
PS AACR-F	72.0	70.0	63.9	56.0	46.1	42.0	36.0	34.0	32.5	30.0	28.0	5.0
Prop Delay (ns)	580	562	555	552	549	548	547	546	546	546	546	0.0
Delay Skew (ns)	50	50	50	50	50	50	50	50	50	50	50	0.0

- Category 3, balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
- All balanced twisted-pair backbone cables exceeding 90 m (295 ft) or 100 m (328 ft) shall be 100% tested for continuity if applications assurance is not required.
- 500 MHz Category 6A balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

TEST EQUIPMENT CRITERIA

- All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
- Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters
- Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

01 33 19: FIBER OPTIC TESTING

BACKBONE FIBER TESTING

- Fiber horizontal cables shall be 100% tested for insertion loss and length.
- Insertion loss shall be tested at 850 nm and 1300 nm for 50/125µm and 62.5/125µm multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
- Insertion loss shall be tested at 1310 and 1550 for Singlemode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
- Length shall be recorded using an OTDR, optical length test measurement device or sequential cable measurement markings.
- The backbone link performance guarantees are as follows:

Backbone Link Performance	
Parameter	Singlemode (1310nm/1550nm)

	Indoor Cable	Outdoor Cable
Max. Attenuation (dB)	2.9/2.9	1.85/1.55
Zero Dispersion Wavelength (nm) [1]	1300 - 1322	
Zero Dispersion Slope (nm^2•km) [1]	<0.092	
Gigabit Transmission Distance (m) [2]	3,000/3,000	
10 Gigabit Transmission Distance (m) [3]	3,000/3,000	
Min. Return Loss (dB) [4]	40	

[1] Dispersion is an important performance parameter, but because it is intrinsic to the fiber and cannot be adversely affected by installation practices, it does not require testing in the field.

[2] The protocol pertinent to the transmission distances as noted is Gigabit Ethernet per IEEE 802.3z.

[3] The protocol pertinent to the transmission distances as noted is 10 Gigabit Ethernet per IEEE 802.3ae.

[4] If the insertion loss is within the limits as noted in the above chart, it is indicative that the Return Loss performance of the link will be within the limits as indicated.

Acceptable attenuation test results shall be determined using the following calculation:

Link Attenuation = Cable Attenuation + Connector Attenuation + Splice Attenuation

where:

Cable Attenuation (dB) = Attenuation Coefficient (dB/km) x length (km)

Attenuation Coefficient (Inside Plant) = 0.5 dB/km @ 1310 and 1550 nm

Attenuation Coefficient (Outside Plant) = 0.4 dB/km @ 1310; 0.3 dB/km @ 1550 nm

Connector Attenuation (dB) = Number of Connector Pairs (n) x Connector Loss = n x 0.5 dB

Splice Attenuation (dB) = Number of Splices (s) x Splice Loss (dB) = s x 0.3 dB

ADMINISTRATION & DOCUMENTATION

27 05 53: LABELING

- Horizontal and backbone cables shall be labeled at each end. The cable or its label shall be marked with its identifier.
- A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- Each port in the faceplate shall be labeled with its identifier.
- A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- Each port on the connecting hardware shall be labeled with its identifier.

01 33 23: DRAWINGS

As-built drawings shall be supplied by the contractor showing the locations of and identifiers for all:

- Horizontal cable routing and terminations
- Telecommunications outlets/connectors
- Backbone cable routing and terminations

01 33 29: RECORDS AND REPORTS

All records shall be created by the installation contractor and turned over at the completion of work

The format shall be computer based and both soft copies and hard copies shall be part of the As-built package. The minimum requirements include:

- Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
- Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
- Test documentation on all cable types shall be included as part of the As-built package.

All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:

- Cable Reports
- Cross-connect Reports
- Connecting Hardware Reports

WARRANTY

Either a basic link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

01 33 13: SYSTEM WARRANTY

A twenty (20) year warranty available for the 500 MHz category 6A structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof.

Additional features of the warranty shall include:

- 10G 6A channel specifications on <u>all</u> parameters across the <u>entire</u> frequency range of 1-500 MHz as noted below:

Performance Guarantees for Z-MAX 6A UTP Channels												
Parameter	**Frequency (MHz)**											**Guaranteed Margin[1] (1-500 MHz)**
	1	**4**	**10**	**20**	**62.5**	**100**	**200**	**250**	**300**	**400**	**500**	
Insertion Loss	2.2	4.0	6.3	8.9	15.9	20.3	29.2	32.9	36.2	42.3	47.8	3%
Return Loss	22.0	22.0	22.0	20.5	17.0	15.0	12.0	11.0	10.2	9.0	9.0	3.0
NEXT	68.0	66.0	59.6	54.6	46.4	42.9	37.8	36.1	34.7	32.6	30.9	3.0
PS NEXT	65.5	64.0	57.5	52.5	44.1	40.6	35.4	33.7	32.3	30.1	28.3	3.5
ACR-N	67.0	64.9	56.1	48.5	33.0	25.0	10.7	5.2	0.4	-8.1	-15.4	6.0
PS ACR-N	64.5	62.9	54.0	46.3	30.7	22.7	8.3	2.8	-2.1	-10.6	-18.0	6.5
ACR-F	70.3	58.2	50.3	44.2	34.3	30.3	24.2	22.3	20.7	18.2	16.3	7.0
PS ACR-F	70.3	58.2	50.3	44.2	34.3	30.3	24.2	22.3	20.7	18.2	16.3	10.0
PS ANEXT	68.0	68.0	68.0	68.0	63.0	61.0	56.5	55.0	53.8	52.0	50.5	1.0
PS AACR-F	68.0	66.0	59.9	52.0	42.1	38.0	32.0	30.0	28.5	26.0	24.0	1.0
Prop Delay (ns)	580	562	555	552	549	548	547	546	546	546	546	0.0
Delay Skew (ns)	50	50	50	50	50	50	50	50	50	50	50	0.0

- Performance claims based on worst case testing and channel configurations

01 33 13: PRODUCT WARRANTY

The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on its entire product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.

01 86 29: APPLICATIONS SUPPORTED

Existing and future applications supported for a channel model warranty include those approved by the Institute of Electronic and Electrical Engineers (IEEE), the Asynchronous Transfer Mode (ATM) Forum, the American National Standards Institute (ANSI) or the International Organization of Standards (ISO) that specify compatibility with the cabling referenced herein.

Missouri
Division of Labor Standards

WAGE AND HOUR SECTION

JEREMIAH W. (JAY) NIXON, Governor

Annual Wage Order No. 16

Section 026

COLE COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Carla Buschjost, Director
Division of Labor Standards

This Is A True And Accurate Copy Which Was Filed With The Secretary of State: **March 10, 2009**

Last Date Objections May Be Filed: **April 9, 2009**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Effective Date of Increase	*	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Asbestos Worker	10/09		$30.76	55	60	$16.61
Boilermaker			$32.30	57	7	$19.80
Bricklayers-Stone Mason			$26.98	59	7	$12.65
Carpenter	4/09		$23.29	60	15	$11.00
Cement Mason	3/09		$22.99	9	3	$10.59
Electrician (Inside Wireman)			$29.07	28	7	$11.32 + 13%
Communication Technician			USE ELECTRICIAN (INSIDE WIREMAN) RATE			
Elevator Constructor		a	$39.715	26	54	$19.715
Operating Engineer						
Group I	5/09		$25.92	86	66	$18.37
Group II	5/09		$25.92	86	66	$18.37
Group III	5/09		$24.67	86	66	$18.37
Group III-A	5/09		$25.92	86	66	$18.37
Group IV	5/09		$23.69	86	66	$18.37
Group V	5/09		$26.62	86	66	$18.37
Pipe Fitter		b	$33.00	91	69	$19.68
Glazier			$15.75	FED		$2.16
Laborer (Building):						
General			$19.61	110	7	$9.64
First Semi-Skilled			$21.61	110	7	$9.64
Second Semi-Skilled			$20.61	110	7	$9.64
Lather			USE CARPENTER RATE			
Linoleum Layer & Cutter			USE CARPENTER RATE			
Marble Mason			$26.98	59	7	$12.65
Millwright	4/09		$24.29	60	15	$11.00
Iron Worker	8/09		$26.41	11	8	$17.80
Painter	2/09		$21.40	18	7	$8.82
Plasterer	3/09		$22.01	94	5	$10.38
Plumber			$25.31	FED		$3.05
Pile Driver	4/09		$24.29	60	15	$11.00
Roofer	9/09		$27.25	12	4	$11.89
Sheet Metal Worker	7/09		$27.89	40	23	$12.92
Sprinkler Fitter			$17.00	FED		$2.69
Terrazzo Worker			$26.98	59	7	$12.65
Tile Setter			$26.98	59	7	$12.65
Truck Driver-Teamster						
Group I	3/09		$23.25	101	5	$8.55
Group II	3/09		$23.90	101	5	$8.55
Group III	3/09		$23.40	101	5	$8.55
Group IV	3/09		$23.90	101	5	$8.55
Traffic Control Service Driver	5/09		$26.415	22	55	$9.045
Welders-Acetylene & Electric		*				

Fringe Benefit Percentage is of the Basic Hourly Rate

Attention Workers: If you are not being paid the appropriate wage rate and fringe benefits contact the Division of Labor Standards at (573) 751-3403.

**Annual Incremental Increase

OCCUPATIONAL TITLE	Effective Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits

* Welders receive rate prescribed for the occupational title performing operation to which welding is incidental.

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

a - Vacation: Employees over 5 years - 8%; Employees under 5 years - 6%
b - All work over $7 Million Total Mechanical Contract - $33.00, Fringes - $19.68
All work under $7 Million Total Mechanical Contract - $31.66, Fringes - $14.81

REPLACEMENT PAGE
COLE COUNTY
OVERTIME SCHEDULE - BUILDING CONSTRUCTION

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 9: Means the regular workday starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one hour to 9:00 a.m. All work performed in excess of the regular work day and on Saturday shall be compensated at one and one-half (1½) times the regular pay. In the event time is lost during the work week due to weather conditions, the Employer may schedule work on the following Saturday at straight time. All work accomplished on Sunday and holidays shall be compensated for at double the regular rate of wages. The work week shall be Monday through Friday, except for midweek holidays.

NO. 11: Means eight (8) hours shall constitute a day's work, with the starting time to be established between 6:00 a.m. and 8:00 a.m. from Monday to Friday. Time and one-half (1½) shall be paid for first two (2) hours of overtime Monday through Friday and the first eight (8) hours on Saturday. All other overtime hours Monday through Saturday shall be paid at double (2) time rate. Double (2) time shall be paid for all time on Sunday and recognized holidays or the days observed in lieu of these holidays.

NO. 12: Means the work week shall commence on Monday at 12:01 a.m. and shall continue through the following Friday, inclusive of each week. All work performed by employees anywhere in excess of forty (40) hours in one (1) work week, shall be paid for at the rate of one and one-half (1½) times the regular hourly wage scale. All work performed within the regular working hours which shall consist of a ten (10) hour work day except in emergency situations. Overtime work and Saturday work shall be paid at one and one-half (1½) times the regular hourly rate. Work on recognized holidays and Sundays shall be paid at two (2) times the regular hourly rate.

NO. 18: Means the regular work day shall be eight (8) hours. Working hours are from six (6) hours before Noon (12:00) to six (6) hours after Noon (12:00). The regular work week shall be forty (40) hours, beginning between 6:00 a.m. and 12:00 Noon on Monday and ending between 1:00 p.m. and 6:00 p.m. on Friday. Saturday will be paid at time and one-half (1½). Sunday and Holidays shall be paid at double (2) time. Saturday can be a make-up day if the weather has forced a day off, but only in the week of the day being lost. Any time before six (6) hours before Noon or six (6) hours after Noon will be paid at time and one-half (1½).

NO. 22: Means a regular work week of forty (40) hours will start on Monday and end on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A workday is to begin between 6:00 a.m. and 9:00 a.m. However, the project starting time may be advanced or delayed if mutually agreed to by the interest parties. For all time worked on recognized holidays, or days observed as such, double (2) time shall be paid.

NO. 26: Means that the regular working day shall consist of eight (8) hours worked between 6:00 a.m., and 5:00 p.m., five (5) days per week, Monday to Friday, inclusive. Hours of work at each jobsite shall be those established by the general contractor and worked by the majority of trades. (The above working hours may be changed by mutual agreement). Work performed on Construction Work on Saturdays, Sundays and before and after the regular working day on Monday to Friday, inclusive, shall be classified as overtime, and paid for at double (2) the rate of single time. The employer may establish hours worked on a jobsite for a four (4) ten (10) hour day work week at straight time pay for construction work; the regular working day shall consist of ten (10) hours worked consecutively, between 6:00 a.m. and 6:00 p.m., four (4) days per week, Monday to Thursday, inclusive. Any work performed on Friday, Saturday, Sunday and holidays, and before and after the regular working day on Monday to Thursday where a four (4) ten (10) hour day workweek has been established, will be paid at two times (2) the single time rate of pay. The rate of pay for all work performed on holidays shall be at two times (2) the single time rate of pay.

REPLACEMENT PAGE
COLE COUNTY
OVERTIME SCHEDULE - BUILDING CONSTRUCTION

NO. 28: Means a regular workday shall consist of eight (8) hours between 7:00 a.m. and 5:30 p.m., with at least a thirty (30) minute period to be taken for lunch. Five (5) days a week, Monday through Friday inclusive, shall constitute a work week. The Employer has the option for a workday/workweek of four (4) ten (10) hour days (4-10's) provided:

-The project must be for a minimum of four (4) consecutive days.
-Starting time may be within one (1) hour either side of 8:00 a.m.
-Work week must begin on either a Monday or Tuesday: If a holiday falls within that week it shall be a consecutive work day. (Alternate: If a holiday falls in the middle of a week, then the regular eight (8) hour schedule may be implemented).
-Any time worked in excess of any ten (10) hour work day (in a 4-10 hour work week) shall be at the appropriate overtime rate.

All work outside of the regular working hours as provided, Monday through Saturday, shall be paid at one & one-half (1½) times the employee's regular rate of pay. All work performed from 12:00 a.m. Sunday through 8:00 a.m. Monday and recognized holidays shall be paid at double (2) the straight time hourly rate of pay. Should employees work in excess of twelve (12) consecutive hours they shall be paid double time (2X) for all time after twelve (12) hours. Shift work performed between the hours of 4:30 p.m. and 12:30 a.m. (second shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus ten (10%) percent for seven and one-half (7½) hours work. Shift work performed between the hours of 12:30 a.m. and 8:00 a.m. (third shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus fifteen (15%) percent for seven (7) hours work. A lunch period of thirty (30) minutes shall be allowed on each shift. All overtime work required after the completion of a regular shift shall be paid at one and one-half (1½) times the shift hourly rate.

NO. 40: Means the regular working week shall consist of five (5) consecutive (8) hour days' labor on the job beginning with Monday and ending with Friday of each week. Four (4) 10-hour days may constitute the regular work week. The regular working day shall consist of eight (8) hours labor on the job beginning as early as 7:00 a.m. and ending as late as 5:30 p.m. All full or part time labor performed during such hours shall be recognized as regular working hours and paid for at the regular hourly rate. All hours worked on Saturday and all hours worked in excess of eight (8) hours but not more than twelve (12) hours during the regular working week shall be paid for at time and one-half (1½) the regular hourly rate. All hours worked on Sundays and holidays and all hours worked in excess of twelve (12) hours during the regular working day shall be paid at two (2) times the regular hourly rate. In the event of rain, snow, cold or excessively windy weather on a regular working day, Saturday may be designated as a "make-up" day. Saturday may also be designated as a "make-up" day, for an employee who has missed a day of work for personal or other reasons. Pay for "make-up" days shall be at regular rates.

NO. 55: Means the regular work day shall be eight (8) hours between 6:00 a.m. and 4:30 p.m. The first two (2) hours of work performed in excess of the eight (8) hour work day, Monday through Friday, and the first ten (10) hours of work on Saturday, shall be paid at one & one-half (1½) times the straight time rate. All work performed on Sunday, observed holidays and in excess of ten (10) hours a day, Monday through Saturday, shall be paid at double (2) the straight time rate.

NO. 57: Means eight (8) hours per day shall constitute a day's work and forty (40) hours per week, Monday through Friday, shall constitute a week's work. The regular starting time shall be 8:00 a.m. The above may be changed by mutual consent of authorized personnel. When circumstances warrant, the Employer may change the regular workweek to four (4) ten-hour days at the regular time rate of pay. It being understood that all other pertinent information must be adjusted accordingly. All time worked before and after the established workday of eight (8) hours, Monday through Friday, all time worked on Saturday, shall be paid at the rate of time and one-half (1½) except in cases where work is part of an employee's regular Friday shift. All time worked on Sunday and recognized holidays shall be paid at the double (2) time rate of pay.

REPLACEMENT PAGE
COLE COUNTY
OVERTIME SCHEDULE - BUILDING CONSTRUCTION

NO. 59: Means that except as herein provided, eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work. All time worked outside of the standard eight (8) hour work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½). All time worked on Sunday and holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight hour days or four (4) ten hour days to constitute a normal forty (40) hour work week. When the four (4) ten-hour work week is in effect, the standard work day shall be consecutive ten (10) hour periods between the hours of 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a weeks work, Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed ten (10) hours or forty (40) hours per week. When the five day (8) hour work week is in effect, forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours or forty (40) hours per week. The regular starting time (and resulting quitting time) may be moved to 6:00 a.m. or delayed to 9:00 a.m. Make-up days shall not be utilized for days lost due to holidays.

NO. 60: Means the Employer shall have the option of working five 8-hour days or four 10-hour days Monday through Friday. If an Employer elects to work five 8-hour days during any work week, hours worked more than eight (8) per day or forty (40) per week shall be paid at time and one-half (1½) the hourly wage rate plus fringe benefits Monday through Friday. SATURDAY MAKE-UP DAY: If an Employer is prevented from working forty (40) hours, Monday through Friday, or any part thereof by reason of inclement weather (rain or mud), Saturday or any part thereof may be worked as a make-up day at the straight time rate. It is agreed by the parties that the make-up day is not to be used to make up time lost due to recognized holidays. If an Employer elects to work four 10-hour days, between the hours of 6:30 a.m. and 6:30 p.m. in any week, work performed more than ten (10) hours per day or forty (40) hours per week shall be paid at time and one half (1½) the hourly wage rate plus fringe benefits Monday through Friday. If an Employer is working 10-hour days and loses a day due to inclement weather, the Employer may work ten (10) hours on Friday at straight time. Friday must be scheduled for no more than ten (10) hours at the straight time rate, but all hours worked over the forty (40) hours Monday through Friday will be paid at time and one-half (1½) the hourly wage rate plus fringe benefits. All Millwright work performed in excess of the regular work day and on Saturday shall be compensated for at time and one-half (1½) the regular Millwright hourly wage rate plus fringe benefits. The regular work day starting of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. All work accomplished on Sundays and recognized holidays, or days observed as recognized holidays, shall be compensated for at double (2) the regular hourly rate of wages plus fringe benefits. NOTE: All overtime is computed on the hourly wage rate plus an amount equal to the fringe benefits.

NO. 86: Means the regular work week shall consist of five (5) days, Monday through Friday, beginning at 8:00 a.m. and ending at 4:30 p.m. The regular work day beginning time may be advanced one or two hours or delayed by one hour. However, the Employer may have the option to schedule his work week from Monday through Thursday at ten (10) hours per day at the straight time rate of pay with all hours in excess of ten (10) hours in any one day to be at the applicable overtime rate. If the Employer elects to work from Monday through Thursday and is stopped due to circumstances beyond his control, inclement weather or holiday, he shall have the option to work Friday at the straight time rate of pay to complete his forty (40) hours. If an employee declines to work Friday as a make-up day, he shall not be penalized. All overtime work performed on Monday through Saturday shall be paid at time and one-half (1½) of the hourly rate plus an amount equal to one-half (½) of the hourly Total Indicated Fringe Benefits. All work performed on Sundays and recognized holidays shall be paid at double (2) the hourly rate plus an amount equal to the hourly Total Indicated Fringe Benefits.

NO. 91: Means eight (8) hours shall constitute a day's work commencing at 8:00 a.m. and ending at 4:30 p.m., allowing one-half (½) hour for lunch. The option exists for the Employer to use a flexible starting time between the hours of 6:00 a.m. and 9:00 a.m. The regular workweek shall consist of forty (40) hours of five (5) workdays, Monday through Friday. The workweek may consist of four (4) ten (10) hour days from Monday through Thursday, with Friday as a make-up day. If the make-up day is a holiday, the employee shall be paid at the double (2) time rate. The employees shall be paid time and one-half (1½) for work performed **on Saturdays,** before the regular starting time or after the regular quitting time or over eight (8) hours per work day (unless working a 10-hour work day, then time and one-half (1½) is paid for work performed over ten (10) hours a day) or over forty (40) hours per work week. Work performed on Sundays and recognized holidays shall be paid at the double (2) time rate of pay.

REPLACEMENT PAGE
COLE COUNTY
OVERTIME SCHEDULE - BUILDING CONSTRUCTION

NO. 94: Means eight (8) hours shall constitute a days work between the hours of 8:00 a.m. and 5:00 p.m. The regular workday starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. All work performed in excess of the regular work day and on Saturday shall be compensated at one and one-half (1½) times the regular pay. In the event time is lost during the work week due to weather conditions, the Employer may schedule work on the following Saturday at straight time. All work accomplished on Sunday and holidays shall be compensated at double the regular rate of wages.

NO. 101: Means that except as provided below, eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work, which shall begin on Monday and end on Friday. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½) (except as herein provided). All time worked on Sunday and recognized holidays shall be classified as overtime and paid at the rate of double (2) time. The regular starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When a four (4) ten-hour day work week is in effect, the standard work day shall be consecutive ten (10) hour periods between the hours of 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a week's work Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed ten (10) hours per day or forty (40) hours per week. Starting time will be designated by the employer. When the five (5) day eight (8) hour work week is in effect, forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours per day or forty (40) hours per week. Make-up days shall not be utilized for days lost due to holidays.

NO. 110: Means eight (8) hours between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. The starting time may be advanced one (1) or two (2) hours. Employees shall have a lunch period of thirty (30) minutes. The Employer may provide a lunch period of one (1) hour, and in that event, the workday shall commence at 8:00 a.m. and end at 5:00 p.m. The workweek shall commence at 8:00 a.m. on Monday and shall end at 4:30 p.m. on Friday (or 5:00 p.m. on Friday if the Employer grants a lunch period of one (1) hour), or as adjusted by starting time change as stated above. All work performed before 8:00 a.m. and after 4:30 p.m. (or 5:00 p.m. where one (1) hour lunch is granted for lunch) or as adjusted by starting time change as stated above or on Saturday, except as herein provided, shall be compensated at one and one-half (1½) times the regular hourly rate of pay for the work performed. All work performed on Sunday and on recognized holidays shall be compensated at double (2) the regular hourly rate of pay for the work performed. If an Employer is prevented from working forty (40) hours, Monday through Friday, or any part thereof by reason of inclement weather (rain and mud), Saturday or any part thereof may be worked as a make-up day at the straight time rate. The Employer shall have the option of working five eight (8) hour days or four ten (10) hour days Monday through Friday. If an Employer elects to work five (5) eight (8) hour days during any work week, hours worked more than eight (8) per day or forty (40) hours per week shall be paid at time and one-half (1½) the hourly rate Monday through Friday. If an Employer elects to work four (4) ten (10) hour days in any week, work performed more than ten (10) hours per day or forty (40) hours per week shall be paid at time and one-half (1½) the hourly rate Monday through Friday. If an Employer is working ten (10) hour days and loses a day due to inclement weather, they may work ten (10) hours Friday at straight time. Friday must be scheduled for at least eight (8) hours and no more than ten (10) hours at the straight time rate, but all hours worked over the forty (40) hours Monday through Friday will be paid at time and one-half (1½) overtime rate.

COLE COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 3: All work done on New Year's Day, Decoration Day, July 4th, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day shall be paid at the double time rate of pay. Whenever any such holidays fall on a Sunday, the following Monday shall be observed as a holiday.

NO. 4: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas Day shall be paid at the double time rate of pay. If any of the above holidays fall on Sunday, Monday will be observed as the recognized holiday. If any of the above holidays fall on Saturday, Friday will be observed as the recognized holiday.

NO. 5: All work that shall be done on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day shall be paid at the double (2) time rate of pay.

NO. 7: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day shall be paid at the double time rate of pay. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday.

NO. 8: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day, or the days observed in lieu of these holidays, shall be paid at the double time rate of pay.

NO. 15: All work accomplished on the recognized holidays of New Year's Day, Decoration Day (Memorial Day), Independence Day (Fourth of July), Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, or days observed as these named holidays, shall be compensated for at double (2) the regular hourly rate of wages plus fringe benefits. If a holiday falls on Saturday, it shall be observed on the preceding Friday. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day, Christmas Day, Decoration Day or Independence Day except to preserve life or property.

NO. 23: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day and Sundays shall be recognized holidays and shall be paid at the double time rate of pay. When a holiday falls on Sunday, the following Monday shall be considered a holiday.

NO. 54: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day shall be paid at the double (2) time rate of pay. When a holiday falls on Saturday, it shall be observed on Friday. When a holiday falls on Sunday, it shall be observed on Monday.

NO. 55: The following days are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workmen unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make up day when an observed holiday occurs during the work week. Employees have the option to work that make up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 60: All work performed on New Year's Day, Armistice Day (Veteran's Day), Decoration Day (Memorial Day), Independence Day (Fourth of July), Thanksgiving Day and Christmas Day shall be paid at the double time rate of pay. No work shall be performed on Labor Day except when triple (3) time is paid. When a holiday falls on Saturday, Friday will be observed as the holiday. When a holiday falls on Sunday, the following Monday shall be observed as the holiday.

COLE COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 66: All work performed on Sundays and the following recognized holidays, or the days observed as such, of New Year's Day, Decoration Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, shall be paid at double (2) the hourly rate plus an amount equal to the hourly Total Indicated Fringe Benefits. Whenever any such holidays fall on a Sunday, the following Monday shall be observed as a holiday.

NO. 69: All work performed on New Year's Day, Decoration Day, July Fourth, Labor Day, Veteran's Day, Thanksgiving Day or Christmas Day shall be compensated at double (2) their straight-time hourly rate of pay. Friday after Thanksgiving and the day before Christmas will also be holidays, but if the employer chooses to work these days, the employee will be paid at straight -time rate of pay. If a holiday falls on a Sunday in a particular year, the holiday will be observed on the following Monday.

OCCUPATIONAL TITLE	*Effective Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
CARPENTER					
Journeymen	5/09	$28.57	7	16	$11.00
Millwright	5/09	$28.57	7	16	$11.00
Pile Driver Worker	5/09	$28.57	7	16	$11.00
OPERATING ENGINEER					
Group I	5/09	$25.00	21	5	$18.28
Group II	5/09	$24.65	21	5	$18.28
Group III	5/09	$24.45	21	5	$18.28
Group IV	5/09	$20.80	21	5	$18.28
Oiler-Driver	5/09	$20.80	21	5	$18.28
LABORER					
General Laborer	5/09	$24.56	2	4	$9.29
Skilled Laborer	5/09	$25.16	2	4	$9.29
TRUCK DRIVER-TEAMSTER					
Group I	5/09	$26.22	22	19	$9.40
Group II	5/09	$26.38	22	19	$9.40
Group III	5/09	$26.37	22	19	$9.40
Group IV	5/09	$26.49	22	19	$9.40

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate sheet.

COLE COUNTY
OVERTIME SCHEDULE – HEAVY CONSTRUCTION

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 2: Means a regular workweek shall be forty (40) hours and will start on Monday and end on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof, by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A workday shift is to begin at the option of the Employer, between 6:00 a.m. and not later than 9:00 a.m. However, the project starting time may be advanced or delayed if required. If workmen are required to work the enumerated holidays or days observed as such or Sundays, they shall receive double (2) the regular rate of pay for such work.

NO. 7: Means the regular work week shall start on Monday and end on Friday, except where the Employer elects to work Monday through Thursday, ten (10) hours per day. All work over ten (10) hours in a day or forty (40) hours in a week shall be at the overtime rate of one and one-half (1½) times the regular hourly rate. The regular work day shall be either eight (8) or ten (10) hours. If a job can't work forty (40) hours Monday through Friday because of inclement weather or other conditions beyond the control of the Employer, Friday or Saturday may be worked as a make-up day at straight time (if working 4-10's). Saturday may be worked as a make-up day at straight time (if working 5-8's). Make-up days shall not be utilized for days lost due to holidays. A workday is to begin at the option of the Employer but not later than 11:00 a.m. except when inclement weather, requirements of the owner or other conditions beyond the reasonable control of the Employer prevent work. Except as worked as a make-up day, time on Saturday shall be worked at one and one-half (1½) times the regular rate. Work performed on Sunday shall be paid at two (2) times the regular rate. Work performed on recognized holidays or days observed as such, shall also be paid at the double (2) time rate of pay.

NO. 21: Means the regular workday for which employees shall be compensated at straight time hourly rate of pay shall, unless otherwise provided for, begin at 8:00 a.m. and end at 4:30 p.m. However, the project starting time may be advanced or delayed at the discretion of the Employer. At the discretion of the Employer, when working a five (5) day eight (8) hour schedule, Saturday may be used for a make-up day. If an Employer is prohibited from working on a holiday, that employer may work the following Saturday at the straight time rate. However, the Employer may have the option to schedule his work from Monday through Thursday at ten (10) hours per day at the straight time rate of pay with all hours in excess of ten (10) hours in any one day to be paid at the applicable overtime rate. If the Employer elects to work from Monday through Thursday and is stopped due to circumstances beyond his control, he shall have the option to work Friday or Saturday at the straight time rate of pay to complete his forty (40) hours. If an Employer is prohibited from working on a holiday, that Employer may work the following Friday or Saturday at the straight time rate. Overtime will be at one and one-half (1½) times the regular rate. If workmen are required to work the enumerated holidays or days observed as such, or Sundays, they shall receive double (2) the regular rate of pay for such work.

NO. 22: Means a regular work week of forty (40) hours will start on Monday and end on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A workday is to begin between 6:00 a.m. and 9:00 a.m. However, the project starting time may be advanced or delayed if mutually agreed to by the interested parties. For all time worked on recognized holidays, or days observed as such, double (2) time shall be paid.

COLE COUNTY
HOLIDAY SCHEDULE – HEAVY CONSTRUCTION

NO. 4: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day, or days observed as such, shall be paid at the double time rate of pay. When a holiday falls on a Sunday, Monday shall be observed.

NO. 5: The following days are recognized as holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward a forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workman unless worked. If workmen are required to work the above recognized holidays or days observed as such, or Sundays, they shall receive double (2) the regular rate of pay for such work. The above shall apply to the four 10's Monday through Friday work week. The ten (10) hours shall be applied to the forty (40) hour work week.

NO. 16: The following days are recognized as holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on Sunday, it shall be observed on the following Monday. If a holiday falls on Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid to the worker unless worked. If workers are required to work the above recognized holidays or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 19: The following days are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workmen unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make up day when an observed holiday occurs during the work week. Employees have the option to work that make up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive double (2) the regular rate of pay for such work.

REPLACEMENT PAGE
OUTSIDE ELECTRICIAN

These rates are to be used for the following counties:

Adair, Audrain, Boone, Callaway, Camden, Carter, Chariton, Clark, Cole, Cooper, Crawford, Dent, Franklin, Gasconade, Howard, Howell, Iron, Jefferson, Knox, Lewis, Lincoln, Linn, Macon, Maries, Marion, Miller, Moniteau, Monroe, Montgomery, Morgan, Oregon, Osage, Perry, Phelps, Pike, Pulaski, Putnam, Ralls, Randolph, Reynolds, Ripley, St. Charles, St. Francois, St. Louis City, St. Louis County, Ste. Genevieve, Schuyler, Scotland, Shannon, Shelby, Sullivan, Texas, Warren, and Washington.

COMMERCIAL WORK

Occupational Title	Basic	Total
	Hourly	Fringe
	Rate	Benefits
*Journeyman Lineman	$35.03	$4.75 + 42%
*Lineman Operator	$30.24	$4.75 + 42%
*Groundman	$23.38	$4.75 + 42%

OVERTIME RATE: Eight (8) hours shall constitute a work day between the hours of 7:00 a.m. and 4:30 p.m. Forty (40) hours within five (5) days, Monday through Friday inclusive, shall constitute the work week. Work performed in the 9th and 10th hour, Monday through Friday, shall be paid at time and one-half (1½) the regular straight time rate of pay. Contractor has the option to pay two (2) hours per day at the time and one-half (1½) the regular straight time rate of pay between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. Work performed outside the regularly scheduled working hours and on Saturdays, Sundays and recognized legal holidays, or days celebrated as such, shall be paid for at the rate of double (2) time.

HOLIDAY RATE: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. When one of the foregoing holidays falls on Sunday, it shall be celebrated on the following Monday. When one of the foregoing holidays falls on Saturday, it shall be celebrated on the Friday before the holiday.

UTILITY WORK

Occupational Title	Basic	Total
	Hourly	Fringe
	Rate	Benefits
*Journeyman Lineman	$35.03	$4.75 + 39.55%
*Lineman Operator	$30.24	$4.75 + 39.55%
*Groundman	$23.38	$4.75 + 39.55%

OVERTIME RATE: Eight (8) hours shall constitute a work day between the hours of 7:00 a.m. and 4:30 p.m. Forty (40) hours within five (5) days, Monday through Friday inclusive, shall constitute the work week. Work performed in the 9th and 10th hour, Monday through Friday, shall be paid at time and one-half (1½) the regular straight time rate of pay. Contractor has the option to pay two (2) hours per day at the time and one-half (1½) the regular straight time rate of pay between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. Worked performed in the first eight (8) hours on Saturday shall be paid at the rate of one and eight tenths (1.8) the regular straight time rate. Work performed outside these hours and on Sundays and recognized legal holidays, or days celebrated as such, shall be paid for at the rate of double (2) time.

HOLIDAY RATE: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. When one of the foregoing holidays falls on Sunday, it shall be celebrated on the following Monday. When one of the foregoing holidays falls on Saturday, it shall be celebrated on the Friday before the holiday.

*Annual Incremental Increase