



830 North Summit Street

Toledo, Ohio 43604.1848

t 419.255.4500

f 419.255.4207

www.duketarchitects.com

SPECIFICATIONS

Genoa Bank New Fremont Branch

1701 West State Street
Fremont, Ohio 43420

DAP Project No. 22019

February 16, 2023

Prepared for:

Genoa Banking Company
801 Main Street
Genoa, Ohio 43430

Prepared by:

Duket Architects Planners Inc.

SPECIFICATION INDEX

GENERAL CONDITIONS

Specification Index
Instructions to Bidders
Bid Form
Substitution Sheet
General Conditions/Supplementary Conditions

DIVISION 01 – GENERAL REQUIREMENTS

Section 011100 – Summary of Work
Section 011119 – Contract Considerations
Section 012200 – Unit Prices
Section 012300 – Alternates
Section 013100 – Coordination and Meetings
Section 013300 – Submittal Procedures
Section 014000 – Special Inspections
Section 014500 – Quality Control
Section 015000 – Temporary Facilities and Controls
Section 017000 – Closeout Procedures
Section 017500 – Starting and Adjusting

DIVISION 02 – EXISTING CONDITIONS

Section 023000 – Subsurface Investigation
Section 024119 – Selective Demolition

DIVISION 03 – CONCRETE

Section 033000 – Cast-in-Place Concrete
Section 034500 – Precast Architectural Concrete

DIVISION 04 – MASONRY

Section 042000 – Unit Masonry Systems

DIVISION 05 – METALS

Section 051200 – Structural Steel Framing
Section 055000 – Metal Fabrications

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

Section 061000 – Rough Carpentry and Framing
Section 061600 – Sheathing
Section 061753 – Metal-Plate-Connected Wood Trusses
Section 064020 – Interior Architectural Woodwork
Section 066400 – FRP Paneling

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Section 072100 – Thermal Insulation
Section 072419 – Exterior Insulation and Finish System (EIFS)
Section 072450 – Direct Applied Finish System (DAFS)
Section 076113 – Standing Seam Sheet Metal Roofing
Section 076200 – Sheet Metal Flashing and Trim
Section 079200 – Joint Sealants

DIVISION 08 – OPENINGS

Section 081110 – Hollow Metal Doors and Frames
Section 081210 – Interior Aluminum Frames, Type 2
Section 081400 – Flush Wood Doors
Section 083110 – Access Doors and Frames
Section 084110 – Aluminum Framed Entrances and Storefronts, Type 1
Section 087100 – Door Hardware
Section 088000 – Glazing

DIVISION 09 – FINISHES

Section 092110 – Gypsum Board Assemblies
Section 093000 – Tiling
Section 095100 – Acoustical Ceilings
Section 096500 – Resilient Flooring and Base
Section 096800 – Carpeting
Section 097200 – Wall Coverings
Section 099100 – Painting and Coating

DIVISION 10 – SPECIALTIES

Section 101123 – Tackable Wall Surfaces
Section 101400 – Signage
Section 102200 – Demountable Partitions
Section 102800 – Toilet Accessories
Section 104400 – Fire Protection Specialties

DIVISION 22 – PLUMBING

See Section for Table of Contents

DIVISION 23 – MECHANICAL

See Section for Table of Contents

DIVISION 26 – ELECTRICAL

See Section for Table of Contents

DIVISION 27 – COMMUNICATIONS

See Section for Table of Contents

DIVISION 28 – ELECTRONICS SAFETY & SECURITY

See Section for Table of Contents

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 323119 – Metal Ornamental Fences and Gates

Section 323123 – Plastic Fences

Section 329000 – Exterior Planting

APPENDICES

Geotechnical Subsurface Investigation Report, dated February 15, 2023
as prepared by CT Consultants, Inc. Project No. 229439.

INSTRUCTIONS TO BIDDERS

To be considered, bidders must comply with these instructions

CONTRACT DOCUMENTS

Information, copies of drawings, specifications, proposal forms and other contract documents may be examined or obtained at the following locations:

Newfax Corporation
333 W. Woodruff
Toledo, Ohio 43604
Phone: 419-241-5157
Fax: 419-241-2018
www.newfaxcorp.com

EXAMINATION OF PREMISES

Bidder shall examine the site thoroughly in order to ascertain all conditions that will effect the execution of the work. Failure to do so will not subsequently relieve the successful bidder from full responsibility for the prompt and complete execution of the work in a proper manner and in full compliance with the contract documents. No allowances will be made nor will extra compensation be authorized for difficulties encountered by the Contractor in the performance of the work due to failure to properly appraise conditions prior to submitting their bid.

Similar Genoa Bank branches have been constructed in Sylvania and Port Clinton. An appointment for a site visit may be arranged by contacting Marty Sutter or Erick Scharer at 419 at 419-855-8381.

QUESTIONS

All questions concerning the drawings and specifications shall be submitted to:

Duket Architects Planners
830 North Summit Street
Toledo, Ohio 43604
Phone: 419-255-4500
Joe Thourot
jthourot@duketarchitects.com

Questions which point out a warranted revision to drawings, specifications or other documents will be followed up with a written reply to all prime bidders of record in the form of an addendum and will become a part of the contract documents. Oral clarifications by the Owner or Architect will not be binding.

SUBSTITUTIONS

Bids shall be based upon articles and materials called for in the specifications and drawings.

Substitutions or alternates for materials other than those shown and specified may be submitted on the Substitution Sheet at time of bidding only. To ensure consideration the Contractor shall submit full technical specifications and a complete list of past projects where materials have been used. Contractor shall also

state the amount to be added or deducted from the bid price. Bidders are cautioned to complete the proposal Form according to materials specified. Failure to comply will be cause for rejection of the bid.

PROPOSALS

Proposals shall be made unaltered on Proposal Forms furnished with the contract documents. Proposals shall be signed with name typed below signature. Where bidder is a corporation, proposal must be signed with the legal name of the corporation followed by the name of the state of incorporation and the legal signature of an officer authorized to bind the corporation to a contract. The Seal of Corporation must be affixed beneath the signature.

Submit proposals in duplicate in a sealed envelope. Identify the envelope with the name of the project; name of the bidder; bid date and bid time. The sealed envelope shall be labeled as noted below, and mailed or delivered to the office of:

Bids due March 15, 2023 at 2:00 PM

**Genoa Bank
801 Main Street
Genoa, Ohio 43430
Attn: Marty Sutter, President and CEO**

MODIFICATION AND/OR WITHDRAWAL

Proposals may not be modified after submittal. Bidders may withdraw proposals at any time before bid opening, but may not resubmit them. Proposals shall state that Bids are valid in total for a period of not less than 90 days from the date of opening. Work shall commence within 10 calendar days from date on the Contract.

DISQUALIFICATION

The Owner reserves the right to reject or disqualify any or all proposals.

AWARD

It is the intent of the Owner to award the contract on the basis of the lowest and best bid taking into consideration price and qualifications of bidder and quality of materials and equipment. The Owner reserves the right to waive any informalities or to reject any or all bids.

OPENING

Proposals will be privately opened.

LAWS AND PERMITS

The bidder shall familiarize himself with all Federal, State, EPA and local laws, ordinances and regulations which in any manner may have an effect on the work.

The basic Plan Examination fees will be paid by the Owner. All other fees for other permits, inspections, reviews and licenses shall be included in the amount of the base bid.

PERFORMANCE BOND

If Alternate G-1 is accepted by the Owner, the successful bidder shall be required to provide a Performance Bond and Labor and Material Payment Bond in an amount not less than 100% of the total contract amount, conditioned on the faithful performance of the contract, the completion of the work within the time specified and prompt payment of all persons furnishing labor and materials as necessary for all work.

INSURANCE

Insurance shall be furnished by the contractor in the types and amounts specified in the General Conditions, including Workmen's Compensation, property damage and public liability insurance.

COPIES OF CONTRACTS, BONDS AND INSURANCE

Two executed copies of the contract, bonds and insurance will be required by the Owner.

SALES TAX

The project is taxable.

GUARANTEE

In addition to all guarantees required by project documents, all work furnished and performed under this contract shall be guaranteed against any and all defects in workmanship or materials for a minimum period of (1) year following the date of acceptance of the work by the Owner. Under this guarantee, the Contractor agrees to make good without delay at their own cost and expense any failure of any part of the work due to faulty materials, construction or installation, or to the failure of any equipment to perform successfully all work put upon it within the limits of the specifications and further make good any damages to any part of the work caused by such failures.

END OF INSTRUCTIONS TO BIDDERS

Bidder's Name: _____

BID FORM

Project: **Genoa Bank Fremont Branch
1701 West State Street
Sandusky County
Fremont, Ohio 43420**

Having read and examined the Contract Documents, including without limitation the Drawings and Specifications, prepared by the Architect for the above-referenced Project, and the following Addenda:

Addendum No.	Date of Receipt
_____	_____
_____	_____
_____	_____

The undersigned Bidder proposes to perform all Work for the applicable Contract, in accordance with the Contract Documents, for the following sums. Refer to specification Section 011100 for summary of work and Section 012300 for Alternate.

ITEM 1. GENERAL CONTRACT: BASE BID

ALL LABOR AND MATERIALS for the sum of \$ _____

Sum in Words _____

ITEM 2. ALTERNATE G-1, Performance Bond / Labor and Material Payment Bond

If Alternate is accepted, ADD TO Base Bid: \$ _____

Sum in Words: _____

It is understood and agreed that all Work to be performed under the Contract shall be completed within the established Project time unless an extension of time is granted by the Owner in accordance with the Contract Documents.

OBLIGATIONS: Upon notification of the acceptance of this Proposal, the Undersigned agrees to execute a contract for the above work, for the above-stated compensation. The Undersigned further agrees, if awarded the contract, to execute and deliver to the Owner within five (5) business days after the signing of the contract, satisfactory bonds, in the form of 100% "Performance Bond" and 100% "Labor and Material Payment Bond", according to the laws of the State of Ohio governing this construction work.

Bidder's Name: _____

ITEM 3. UNIT PRICES

UNIT PRICE #1 Removal of Additional Poor Soils at Building Foundations

Soil Removal \$_____ per CY

Engineered Fill \$_____ per CY

UNIT PRICE #2 Undercut Poor Soils at Paving

Undercut Excavation \$_____ per CY

Geogrid Tensar \$_____ per SF

Aggregate \$_____ per CY

ITEM 4. CONSTRUCTION SCHEDULE

The Contractor shall achieve Substantial Completion of the entire Work not later than **December 15, 2023**.

If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, as such time may be adjusted by Change Order, it would be difficult, (if not impossible) to determine the resulting damage to the Owner. Therefore, in such event, the Contractor shall pay to the Owner, or Owner, at its option, may deduct from amounts due Contractor, the sum of **Five Thousand Dollars (\$5,000.00)** for each calendar day beyond the last day of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work.

The Contractor acknowledges that the above-listed liquidated damages are not penalties, and irrevocably waives the right (if any) to challenge the validity and enforceability of those per day sums. Notwithstanding any other provision of the Contract Documents to the contrary, if a court determines that the liquidated damages per day sum or their application are void and unenforceable, the Owner shall be entitled to recover the actual damages that it incurs on account of the Contractor's failure to achieve Substantial Completion within the Contract Time.

The liquidated damages described above are not intended to compensate the Owner for any damages to Owner incurs on account of (1) any claims attributable to the Contractor that are brought by others or (2) any failure of the Contractor to properly, and completely perform the Contract other than the failure to achieve Substantial Completion within the Contract Time, as may be adjusted by Change Order.

1. BIDDER'S CERTIFICATION

The Bidder hereby acknowledges that the following representations in this bid are material and are not mere recitals:

1. Bidder has read and understands the Contract Documents and agrees to comply with all requirements of the Contract Documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder which might indicate a contrary intention.
2. The Bidder represents that the bid is based upon the Standards specified by the Contract Documents.

Bidder's Name: _____

3. Bidder has visited the site, become familiar with local conditions and has correlated personal observations about the requirements of the Contract Documents. The Bidder has no outstanding questions regarding the interpretation of the Contract Documents.
4. During the performance of the Contract, the Bidder agrees to comply with OAC Chapters 123:2-3 through 123:2-9 and agrees to incorporate the provisions contained in the Governor's January 27, 1972 Executive Order into all subcontracts on the Project, regardless of tier. The Bidder understands the State Equal Opportunity Center may conduct pre-award and post-award compliance reviews to determine if the Bidder maintains nondiscriminatory employment practices, maintains an affirmative action program and is exerting good faith efforts to accomplish the goals of the affirmative action program. For a full statement of the rules regarding Equal Employment Opportunity in the Construction Industry, see OAC Chapters 123:2-1 through 123:2-9.
5. The Bidder and each person signing on behalf of the Bidder certifies, and in the case of a joint or combined bid, each party thereto certifies as to such party's organization, under penalty of perjury, that to the best of the undersigned's knowledge and belief: (a) the Base Bid, any Unit Prices and any Alternate Bid in the bid have been arrived at independently without collusion, consultation, communication or agreement, for Unit Prices or Alternate bid with any other Bidder; (b) such Base Bid, Unit Prices or Alternate Bid with any other Prices and any Alternate Bid in the bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to the bid opening, directly or indirectly, to any other bidder who would have any interest in the Base Bid, Unit Prices or Alternate Bid; (c) no attempt has been made or will be made by the Bidder to induce any other individual, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
6. Bidder will enter into and execute the Contract with the Owner, if a Contract is awarded on the basis of this bid, and if the Bidder does not execute a Contract for any reason, other than as authorized by Section 9.31, ORC, or Section 153.54(G), ORC, the Bidder and the Bidder's Surety are liable to the Owner as provided in the Instructions to Bidders.
7. Bidder certifies that upon the award of a Contract, the Contractor will make a good faith effort to ensure that all of the Contractor's employees, while working on Owner property, will not purchase, transfer, use or possess illegal drugs or alcohol or abuse prescription drugs in any way.
8. Bidder agrees to furnish any information requested by the Owner to evaluate the responsibility of the Bidder.
9. Bidder agrees to submit the following submittals, within ten (10) days of the date of the Notice to Award, for execution of the Contract:
 - 9.1 Ohio Workers' Compensation Certificate;
 - 9.2 Certificate of Insurance (ACORD form is acceptable) and copy of additional insured endorsement.

Bidder's Name: _____

If the Bidder is a corporation, partnership or sole proprietorship, an officer, partner or principal of the Bidder, as applicable, shall print or type the legal name of the Bidder on the line provided and sign the Bid Form. If the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall print or type the legal name of the applicable member on the line provided and sign the Bid Form. All signatures must be original.

PRESIDENT'S NAME: _____

Authorized Signature: _____

Print Name: _____

Title: _____

Company Name: _____

Mailing Address: _____

Telephone Number: _____

Facsimile Number: _____

Where Incorporated: _____

Federal Identification Number: _____

Contact Person for Contract Processing: _____

END OF SECTION

GENOA BANK
NEW FREMONT BRANCH

Duket Architects Planners
February 16, 2023

Bidder's Name: _____

SUBSTITUTION SHEET

Refer to Instructions to Bidders regarding the use of materials or methods other than Standards. All bids must be based on the Standard specified.

Bidder shall list here any Substitutions for which consideration is desired, showing the addition or reduction in price to be made for each if the substitution is accepted, or stating "No Change in Price", if none is proposed.

<u>BRAND OR MAKE</u>	<u>PROPOSED SUBSTITUTIONS</u>	<u>ADD</u>	<u>DEDUCT</u>	<u>NO CHANGE</u>
----------------------	-----------------------------------	------------	---------------	------------------

It is understood and agreed that the proposal submitted is based on furnishing Standards as specified and entitles the Owner to require that such named materials and methods be incorporated in the work, except as Substitutions, if they are accepted, based on the quotations entered above, are subsequently made a part of the written contract.

Signed,

Bidder

THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID FORM

GENERAL CONDITIONS / SUPPLEMENTARY CONDITIONS

GENERAL CONDITIONS

The standard form of "General Conditions of the Contract for Construction", of the American Institute of Architects, A201 - 2017 edition, is hereby incorporated into and becomes a part of the Specifications for this work.

SUPPLEMENTARY GENERAL CONDITIONS

The following "Supplementary General Conditions" are subject to all requirements of the General Conditions of the Contract, except as stated above, and modify them as follows.

The following items refer to the General Conditions by Article and Sub-Article numbers:

ARTICLE 2: OWNER

Add the following paragraph 2.2.5.

2.2.5 Notice of Commencement

2.2.5.1 Pursuant to Section 1311.252, ORC, the Owner shall prepare a Notice of Commencement in affidavit form identifying the name and address of the public authority, the Project number, the name, address and trade of all Contractors, the date of execution of the Contracts, and the name and address of the Surety for each Contractor, in addition to the name and address of the Owner's representative upon whom a Claim Affidavit may be served.

2.2.5.2 The Notice of Commencement shall be made available upon request. The unavailability of a Notice of Commencement or incorrect information in the Notice of Commencement does not adversely affect the right of claimants, pursuant to Section 1311.252(C), ORC.

Add the following paragraph 2.3.1.1.

2.3.1.1 The Owner shall secure the required general building permit required by the State of Ohio and/or local jurisdiction.

ARTICLE 9: PAYMENTS AND COMPLETION

Add the following paragraph 9.11 to 9.11.3.

9.11 Retainage

9.11.1 Partial payments to this contractor for material and labor performed under the contract shall be made at the rate of 92 percent of the amount invoiced until The Certificate for Payment which shows the total contract completion at 50 percent or greater, pursuant to Section 153.13, ORC.

- 9.11.2 After the contract is 50 percent complete, as evidenced by payments in the amount of at least 50 percent of the contract price to the contractor. No additional funds shall be retained from payments for material and labor.
- 9.11.3 All funds retained for the faithful performance of the work shall be deposited in an escrow account with a bank in the state in accordance with the terms and conditions provided in an escrow agreement executed by the Contractor, the Owner, and the applicable bank, pursuant to Section 153.63, ORC.

ARTICLE 11: INSURANCE AND BONDS

Add the following Clause 11.1.2.1 to 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits or greater if required by law:

1. Worker's Compensation:
 - a. State Statutory
 - b. Applicable Federal
(e.g., Longshoremen's) Statutory
 - c. Employer's Liability \$1,000,000 per Accident
\$1,000,000 Disease, Policy Limit
\$1,000,000 Disease, Each
Employee
2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage);
 - a. Bodily Injury:
\$1,000,000 Each Occurrence
\$2,000,000 Aggregate
 - b. Property Damage:
\$1,000,000 Each Occurrence
\$2,000,000 Aggregate
 - c. Products and Completed Operations to be maintained for 1 year after final payment:
\$2,000,000 Aggregate
 - d. Property Damage Liability Insurance shall provide X, C, and U coverage.
 - e. Broad Form Property Damage Coverage shall include Complete Operations.
3. Contractual Liability:
 - a. Bodily Injury:

- | | | |
|----|--|-----------------|
| | \$1,000,000 | Each Occurrence |
| | \$2,000,000 | Aggregate |
| 4. | Personal Injury, with Employment Exclusion deleted: | |
| | \$1,000,000 | Aggregate |
| 5. | Business Auto Liability (including owned, non-owned and hired vehicles): | |
| a. | Bodily Injury | |
| | \$1,000,000 | Each Person |
| | \$1,000,000 | Each Occurrence |
| b. | Property Damage: | |
| | \$1,000,000 | Each Occurrence |

Add the following subparagraph 11.4.1.1

- 11.4.1.1 The Contractor shall furnish a performance bond for the entire project.

ARTICLE 13: MISCELLANEOUS PROVISIONS

Add the following paragraphs.

- 13.6 Subcontractors and Material Suppliers
- 13.6.1 Within ten (10) days of the Notice to Proceed, the Contractor shall list the Contractor's proposed Subcontractors and Material Suppliers and submit such list to the Architect.
- 13.6.2 The Contractor shall not replace any Subcontractor or Material Supplier after execution of the Contract without written approval of the Owner.
- 13.6.3 The Contractor shall be fully responsible for all acts and omissions of the Contractor's Subcontractors and Material Suppliers and shall be responsible for scheduling and coordinating the Work of the Contractor's Subcontractors and Material Suppliers.
- 13.6.3.1 Delays attributable to the contractor's Subcontractors or Material Suppliers shall be deemed to be delays within the control of the Contractor.
- 13.6.3.2 The Contractor shall require that each of the Contractor's Subcontractors have a competent supervisor at the Project whenever Work is being performed by the Subcontractor.
- 13.6.3.3 The Contractor agrees to bind the Contractor's Subcontractor and Material Supplier to the terms of the Contract Documents, so far as applicable to the Work of such Subcontractor or Material Supplier.

- 13.6.4 The Contractor shall require each Subcontractor and Material Supplier to fully warrant and guarantee, for the benefit of the Owner, the effectiveness, fitness for the purpose intended, quality and merchantability of any Work performed or item provided or installed by such Subcontractor or Material Supplier.

13.7 Prompt Payment

- 13.7.1 Pursuant to Section 4113.61(A)(1), ORC, if a subcontractor or Material Supplier requests payment in time to allow the Contractor to include the request in the Contractor's Certificate for Payment, the Contractor shall pay within ten (10) days after the receipt of payment from the Owner.
- 13.7.1.1 To a Subcontractor an amount equal to percent of completion allowed by the Owner for the Subcontractor's Work.
- 13.7.1.2 To a Material Supplier an amount equal to all or a portion of the Material Supplier's request for materials furnished.
- 13.7.2 The Contractor may reduce the amount to be paid to a Subcontractor or Material Supplier pursuant to paragraph 9.11 by the amount of any retainage withheld from the Contractor and may withhold amounts necessary to resolve disputed liens or claims involving the Work of the Subcontractor or Material Supplier.
- 13.7.3 If the Contractor fails to comply with the provision of paragraph 9.11, the Contractor shall pay to the applicable Subcontractor or Material Supplier 18 percent interest on any unpaid amount beginning on the 11th day after receipt of payment from the Owner.

END OF SECTION

SPECIFICATION INDEX

GENERAL CONDITIONS

Specification Index
Instructions to Bidders
Bid Form
Substitution Sheet
General Conditions/Supplementary Conditions

DIVISION 01 – GENERAL REQUIREMENTS

Section 011100 – Summary of Work
Section 011119 – Contract Considerations
Section 012300 – Alternates
Section 013100 – Coordination and Meetings
Section 013300 – Submittal Procedures
Section 014000 – Special Inspections
Section 014500 – Quality Control
Section 015000 – Temporary Facilities and Controls
Section 017000 – Closeout Procedures
Section 017500 – Starting and Adjusting

DIVISION 02 – EXISTING CONDITIONS

Section 023000 – Subsurface Investigation
Section 024119 – Selective Demolition

DIVISION 03 – CONCRETE

Section 033000 – Cast-in-Place Concrete
Section 034500 – Precast Architectural Concrete

DIVISION 04 – MASONRY

Section 042000 – Unit Masonry Systems

DIVISION 05 – METALS

Section 051200 – Structural Steel Framing
Section 055000 – Metal Fabrications

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

Section 061000 – Rough Carpentry and Framing
Section 061600 – Sheathing
Section 061753 – Metal-Plate-Connected Wood Trusses
Section 064020 – Interior Architectural Woodwork
Section 066400 – FRP Paneling

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Section 072100 – Thermal Insulation
Section 072419 – Exterior Insulation and Finish System (EIFS)
Section 072450 – Direct Applied Finish System (DAFS)
Section 076113 – Standing Seam Sheet Metal Roofing
Section 076200 – Sheet Metal Flashing and Trim
Section 079200 – Joint Sealants

DIVISION 08 – OPENINGS

Section 081110 – Hollow Metal Doors and Frames
Section 081210 – Interior Aluminum Frames, Type 2
Section 081400 – Flush Wood Doors
Section 083110 – Access Doors and Frames
Section 084110 – Aluminum Framed Entrances and Storefronts, Type 1
Section 087100 – Door Hardware
Section 088000 – Glazing

DIVISION 09 – FINISHES

Section 092110 – Gypsum Board Assemblies
Section 093000 – Tiling
Section 095100 – Acoustical Ceilings
Section 096500 – Resilient Flooring and Base
Section 096800 – Carpeting
Section 097200 – Wall Coverings
Section 099100 – Painting and Coating

DIVISION 10 – SPECIALTIES

Section 101123 – Tackable Wall Surfaces
Section 101400 – Signage
Section 102200 – Demountable Partitions
Section 102800 – Toilet Accessories
Section 104400 – Fire Protection Specialties

DIVISION 22 – PLUMBING

See Section for Table of Contents

DIVISION 23 – MECHANICAL

See Section for Table of Contents

DIVISION 26 – ELECTRICAL

See Section for Table of Contents

DIVISION 27 – COMMUNICATIONS

See Section for Table of Contents

DIVISION 28 – ELECTRONICS SAFETY & SECURITY

See Section for Table of Contents

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 323119 – Metal Ornamental Fences and Gates
Section 323123 – Plastic Fences
Section 329000 – Exterior Planting

APPENDICES

Geotechnical Subsurface Investigation Report, dated February 15, 2023
as prepared by CT Consultants, Inc. Project No. 229439.

SECTION 011100
SUMMARY OF WORK

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work Summary.
- B. Contractor use of site and premises.
- C. Owner occupancy.

1.02 WORK SUMMARY

- A. Base Bid: The Single Prime General Contractor will be responsible for the proper and complete performance of all Work as described in the Contract Documents.
- B. Alternates: See Section 012300 Alternates.

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas identified in the Documents, and as agreed upon with Owner during construction phase.

1.04 OWNER OCCUPANCY

- A. Buildings and site areas adjacent to the area of construction will not be occupied by the Owner during the timeframe identified in the Project Schedule.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 011119

CONTRACT CONSIDERATIONS

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Construction Schedule.
- B. Project Completion Date.
- C. Schedule of Values.
- D. Application for Payment.
- E. Change Procedures.

1.02 PROJECT CONSTRUCTION SCHEDULE

- A. Construction Schedule: The Construction Schedule shall be developed by the General Contractor, in accordance with the Contract Documents. The Construction Schedule is for the purpose of coordinating the timing, phasing, and sequence of the Work of the Contractors and shall not change or modify the Date for Substantial Completion. The Date for Substantial Completion shall only be modified by Change Order, regardless of any dates in the Construction Schedule.
- B. If any Contractor's activities will deviate from the Construction Schedule, the Contractor will notify the General Contractor, Architect and Owner in writing at least two (2) business days in advance of the deviation and provide the Architect and Owner with recommended scheduling information for meeting the Construction Schedule

1.03 PROJECT COMPLETION SCHEDULE

- A. Contractor's attention is called to the Project Schedule. Work and improvements as specified in the Contract Documents shall be completed no later than December 15, 2023 for Substantial Completion. The construction start date shall be no later than April 15, 2023 for contract completion.

The Contractor shall achieve Substantial Completion of the entire Work not later than **December 15, 2023**.

If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, as such time may be adjusted by Change Order, it would be difficult, (if not impossible) to determine the resulting damage to the Owner. Therefore, in such event, the Contractor shall pay to the Owner, or Owner, at its option, may deduct from amounts due Contractor, the sum of **Five Thousand Dollars (\$5,000.00)** for each calendar day beyond the last day of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work.

The Contractor acknowledges that the above-listed liquidated damages are not penalties, and irrevocably waives the right (if any) to challenge the validity and enforceability of those per day sums. Notwithstanding any other provision of the Contract Documents to the contrary, if a court determines that the liquidated damages per day sum or their application are void and unenforceable, the Owner shall be entitled to recover the actual damages that it incurs on account of the Contractor's failure to achieve Substantial Completion within the Contract Time.

The liquidated damages described above are not intended to compensate the Owner for any damages to Owner incurs on account of (1) any claims attributable to the Contractor that are brought by others or (2) any failure of the Contractor to properly, and completely perform the Contract other than the failure to achieve Substantial Completion within the Contract Time, as may be adjusted by Change Order.

1.04 SCHEDULE OF VALUES

- A. Submit digital schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet.
- B. Submit Schedule of Values within 10 days of the Owner's execution of the Agreement.
- C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance, and other pertinent information.
- D. Include in each line item, the amount of Allowances specified in this Section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- E. Include separately from each line item, a directly proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.05 APPLICATIONS FOR PAYMENT

- A. Submit digital copies of each application on AIA Form G702 - Application and Certificate for Payment.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: Monthly.
- D. Waiver of Lien: Must be submitted with each Payment Application after the first.

1.06 CHANGE PROCEDURES

- A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, by issuing supplemental instructions on AIA Form G710.
- B. The Architect/Engineer may issue a Proposal Request or which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Contractor will prepare and submit an estimate with 15 days, and will include a revised project schedule.
- C. The Contractor may propose a change by submitting 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, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.
- D. Stipulated Sum/Price Change Order: Based on Proposal Request or Bulletin and Contractor's fixed maximum price quotation or Contractor's request for a Change Order as approved by Architect/Engineer.

- 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. Change Order Forms: AIA G701/AIA G701/CM Change Order.
- H. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

END OF SECTION

SECTION 012200

UNIT PRICES

1. PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 SUMMARY

- A. This Section covers those items for which indefinite quantities can be expected and, therefore, pre-agreed prices per unit of work are established as means to determine adjustments to the Contract Price after actual quantities are determined. State the amount in the proposal form to be added to or deducted from the Contract Sum for the work.

1.03 QUANTITIES AND COST ADJUSTMENTS

- A. Refer to individual Specification Sections for methods of measurement and payment for unit prices. As soon as the work involved in each unit cost item has been completed, submit documentation to establish the actual quantities provided. Submit to the Architect for review and issuance of Change Order.
- B. Change Order amount for each unit cost item will be based on actual quantities multiplied by the unit price. This unit price includes all costs as described below.

1.04 UNIT PRICES

- A. Should certain additional work be required, or should the quantities of certain classes of work be increased or decreased from those required by the Contract Documents, by authorization of the Owner, the below unit prices shall, at the option of the Owner, be the basis of payment to the Contractor or credit to the Owner, for such increase or decrease in the work.
- B. The Unit Prices shall represent the exact net amount per unit to be paid the Contractor (in the case of additions or increases) or to be refunded the Owner (in the case of decreases). No additional adjustment will be allowed for materials, installation, substrate preparation, overhead, profit, insurance, general conditions, or other direct or indirect expenses of the Contractor or Subcontractors.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

3.01 SCHEDULE OF UNIT PRICES

- A. Unit Price #1: Removal of additional poor soils at building foundations.

The Contractor's fee and costs for all labor, material and equipment, and other expenses contemplated for removal of additional poor soils at building foundations. Based on the Geotechnical Soils Report, poor soils will be encountered to depths of five to seven feet around the site. The Base Bid shall include the removal of poor soils to a depth of five feet. The Unit Price shall be for the deeper removal of soils, if necessary, and the additional engineered fill thereby required. Unit prices are not included in the base bid.

B. Unit Price #2: Undercut poor soils at paving.

The Contractor's fee and costs for all labor, material and equipment, and other expenses contemplated for the Work as described in the Pavement Undercutting Detail on Civil Drawing C-13, if necessary. Unit prices are not included in the base bid.

END OF SECTION

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. For each of the alternates Scheduled at the end of this Section, state the amount in the proposal to be added to or deducted from the Contract Sum for the work.

1.3 ALTERNATES

- A. Definition: "Alternates" are alternate products, materials, equipment, systems, methods, units of work or major elements of the construction, which may, at the Owner's option and under the terms established by the Contract or Agreement, be selected for the work in lieu of the corresponding requirements of the Contract Documents. Selection may occur prior to the Contract Date, or may, by the Agreement, be deferred for possible selection at a subsequent date.
- B. Alternate Requirements: A Schedule of Alternates is included at the end of this Section. Each alternate is defined using abbreviated language, recognizing that the Contract Documents define the requirements. Coordinate related work to ensure that work affected by each alternate is complete and properly interfaced with work of each selected alternate.
- C. Provide written proposals for each alternate on the Bid Form for Owner's consideration. Each proposal amount shall include the entire cost of the alternate portion of the work including overhead, profit, and other costs including cost of interfacing and coordinating the alternate with related and adjacent work.
- D. Selection of Alternates: Selection of alternates to be included in the work will be by the Owner.
- E. Notification: Immediately following award of Contract, prepare and distribute to each entity a notification of status of each alternate. Indicate which alternates have been accepted, rejected, or deferred for consideration at a later date. Include full description of negotiated modifications to alternates, if any

PART 2 - PRODUCTS [Not Used]

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate G-1: Performance Bond / Labor and Material Payment Bond.

State the amount on the proposal form to add to the base bid the amount to furnish a Performance Bond / Labor and Material Payment Bond.

END OF SECTION

SECTION 013100
COORDINATION AND MEETINGS

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Coordination.
- B. Preconstruction/site mobilization conference.
- C. Progress meetings.

1.02 RELATED SECTIONS

- A. All Sections.

1.03 COORDINATION

- A. **The Bidding Contractor shall be the lead contractor, and shall be responsible for coordinating all work on the project in a sequential and timely manner.**
- B. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later, and for accommodating Owner occupancy.
- C. Verify that utility requirement 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.
- D. Coordinate space requirements and installation of mechanical, electrical, and all other work which is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
- G. 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.

1.04 PRECONSTRUCTION/SITE MOBILIZATION CONFERENCE

- A. Refer to General Conditions for Owner scheduling of preconstruction meeting.
- B. Contractor's Superintendents or suppliers as requested by the Architect/Engineer.

- B. Agenda:
1. Distribution of Contract Documents.
 2. Values, and progress schedule.
 3. Designation of personnel representing the parties in Contract, and the Architect/Engineer.
 4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
 5. Scheduling.
 6. Scheduling activities of testing agencies.
 7. Use of premises by Owner and Contractor.
 8. Owner's requirements.
 9. Construction facilities and controls.
 10. Temporary utilities.
 11. Security and housekeeping procedures.
 12. Schedules.
 13. Procedures for maintaining record documents.

1.05 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work per requirements of General Conditions.
- B. Bi-weekly progress meeting will be scheduled with required attendance by a representative of the Contractor, and all subcontractors as required.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Shop drawings.
- E. Product data.

1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with an accepted transmittal form to Architect/Engineer.
- B. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.
- C. Apply Contractor's stamp, signed or initialed certifying that review, 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. Provide space for Contractor and Architect/Engineer review stamps.
- F. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- G. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. The General Contractor shall submit initial progress schedule in duplicate within 10 days after date established in Notice to Proceed for Architect/Engineer review.
- B. When revisions are required revise and resubmit to Architect prior to subsequent project meeting.
- C. Submit a computer generated chart with separate line for each section of Work, identifying first work day of each week.
- D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

- E. Indicate estimated percentage of completion for each item of Work at each submission.

1.04 PROPOSED PRODUCTS LIST

- A. Within 10 days after date of Notice to Proceed, submit complete 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.

1.05 SHOP DRAWINGS

- A. Submit one (1) digital copy via email directly to Architect for review. The Contractor's stamp of review or approval is to be completed prior to submitting to Architect.
- B. After review, reproduce and distribute in accordance with Article on Procedures above and for Record Documents described in Section 017000 - Contract Closeout.

1.02 PRODUCT DATA

- A. Submit one (1) digital copy via email directly to Architect for review. The Contractor's stamp of review or approval is to be completed prior to submitting to Architect. Actual samples shall be delivered directly to the Architect.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Within 10 days after date of Notice to Proceed, submit 3 copies of color samples for each item requiring color selection.
- D. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 017000 - Contract Closeout.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not used

END OF SECTION

SECTION 014000

SPECIAL INSPECTIONS

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Special Inspections requirements.
- B. Statement of Special Inspections.

1.02 SUMMARY

- A. This Section summarizes the responsibility of the Contractor and the Testing/Inspection Agency in the performance of the testing/inspection specified in the Contract Documents.
- B. Neither the observations of the Design Professional in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Design Professional shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.
- C. Special Inspection reports and a final report in accordance with local jurisdiction and State of Ohio code requirements shall be submitted to the Architect prior to the time that phase of work is approved for occupancy.
- D. The Statement of Special Inspections form included here is for reference only.

1.03 REFERENCES

- A. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- C. American Council of Independent Laboratories –Recommended Requirements for Independent Laboratories Qualifications.

1.04 SELECTION AND PAYMENT

- A. The Owner will select the Testing/Inspection Agency and will pay for the testing and special inspection services that are required by local jurisdiction and State of Ohio code requirements.
- B. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with Contract Documents due to negligence or nonconformance.
- C. Contractor shall pay for any additional structural testing/inspection required for his convenience.

1.05 QUALITY ASSURANCE

- A. Testing/Inspection Agency Qualifications: In accordance with local jurisdiction and State of Ohio code requirements.



Statement of Special Inspections

State CPA No.:

Project Name: GENOA BANK

Project Location: 1701 STATE ST. FREMONT, OH 43420

Pursuant to section 1704.2.3 Ohio Building Code, this statement of special inspections must be prepared by the applicant acting as the owner's agent. This statement (2-part documents) should be submitted as a condition for plan approval and should include the following:

- **Part I:** A complete list of materials and work requiring special inspections and the required frequency of inspections by sections 1705.1 through 1705.18 Ohio Building Code.
- **Part II:** A list of special inspectors who are qualified and are competent to the particular type of construction or operations. **These special inspectors shall be employed by the owner or owner's representative, other than contractor. Submit proper resumes and/or certificates of the special inspectors.**

** Please mark "X" on all work items requiring special inspection and the required frequency of inspections for this project per requirements in section 1705 OBC.

PART I: SCHEDULE OF SPECIAL INSPECTIONS				
No.	ITEM	Req'd	Continuous Inspection	Periodic Inspection
1	Special cases: (1705.1.1 OBC)			
2	Steel Construction (1705.2 OBC)	X	X	X
	▪ Structural steel	X	X	X
	▪ Cold form steel deck			
	▪ Open-web steel joists and joist girders			
	▪ Cold form steel trusses spanning ≥ 60 feet			
3	Concrete construction (1705.3 OBC)	X		X
	▪ Welding reinforcing bars	X		X
	▪ Material tests	X		X
4	Masonry Construction (1705.4 OBC)	X		X
	▪ Empirically designed in risk category 4			
	▪ Vertical masonry foundation elements	X		X
5	Wood Construction (1705.5 OBC)			
	▪ High-load diaphragms			

Bureau of Building Code Compliance
6606 Tussing Road
Reynoldsburg, OH 43068-9009

An Equal Opportunity Employer and Service Provider

614-644-2622
Fax 614-644-3145
TTY/TDD 800-750-0750
com.ohio.gov

Ohio Department of Commerce

Special Inspection Statement

	▪ Wood trusses spanning \geq 60 feet			
6	Soils (1705.6 OBC)	X	X	X
7	Driven Deep Foundation (1705.7 OBC)			
8	Cast-In-Place Deep Foundation (1705.8 OBC)			
9	Helical Pile Foundation (1705.9 OBC)			
10	Fabricated items (1705.10 OBC)			
11	Wind resistance (1705.11 OBC)			
	▪ Structural wood			
	▪ Cold-form steel light framed construction			
	▪ Wind resisting components			
12	Seismic resistance (1705.12 OBC)			
	▪ Structural steel			
	▪ Structural wood			
	▪ Cold-formed steel light-frame construction			
	▪ Designated seismic systems			
	▪ Architectural components			
	▪ Plumbing, mechanical, electrical components			
	▪ Storage racks			
	▪ Seismic isolation systems			
	▪ Cold-form steel special bolted moment frame			
13	Testing for seismic resistance (1705.13 OBC)			
	▪ Structural steel			
	▪ Nonstructural components			
	▪ Designated seismic systems			
	▪ Seismic isolation systems			
14	Sprayed fire-resistant materials (1705.14 OBC)			
	▪ Physical & visual tests			
	▪ Structural member surface conditions			
	▪ Application			
	▪ Thickness			
	▪ Density			
	▪ Bond strength			
15	Fire resistant coatings (1705.15 OBC)			
16	EFIS system (1705.16 OBC)			
	▪ Water resistive barrier coating			

Ohio Department of Commerce

Special Inspection Statement

17	Fire-resistant penetration/joint (1705.17 OBC)			
	▪ Penetration firestops			
	▪ Fire-resistant joint systems			
18	Testing for smoke control (1705.18 OBC)			
	▪ Testing scope			
	▪ Qualifications			

- Submit the resume of special inspectors for all marked special inspection items in the part I table showing the qualification and/or special training per 1704.1 OBC.

PART II: LIST OF SPECIAL INSPECTORS			
No.	ITEM	Inspection Company	Name of Inspector
1	Special cases: (1705.1 OBC)		
2	Steel Construction (1705.2 OBC)		
3	Concrete construction (1705.3 OBC)		
4	Masonry Construction (1705.4 OBC)		
5	Wood Construction (1705.5 OBC)		
6	Soils (1705.6 OBC)		
7	Driven Deep Foundation (1705.7 OBC)		
8	Cast-In-Place Deep Foundation (1705.8 OBC)		
9	Helical Pile Foundation (1705.9 OBC)		

Ohio Department of Commerce

Special Inspection Statement

10	Fabricated items (1705.10 OBC)		
11	Wind resistance (1705.11 OBC)		
12	Seismic resistance (1705.12 OBC)		
13	Testing for seismic resistance (1705.13 OBC)		
14	Sprayed fire-resistant materials (1705.14 OBC)		
15	Mastic & intumescent fire- resistant coatings (1705.15 OBC)		
16	EFIS system (1705.16 OBC)		
17	Fire-resistant penetrations and joints (1705.17 OBC)		
18	Testing for smoke control system (1705.18)		

The above statement of special inspections has been prepared by the applicant in accordance with the provision of section 1704.3 Ohio Building Code 2017.

The project registered design professional in responsible charge also acknowledges that he or she is responsible for reviewing and approving the special inspection reports submitted by the special inspectors at the required inspection periods. Any discrepancies in special inspection reports shall be brought to the attention of the building official. A final special inspection report documenting required special inspections and tests, and corrections of any discrepancies noted in the inspections or tests shall be submitted at a point of time agreed upon prior to the start of work by the owner or the owner's representative to the building official prior to the issuance of the certificate of occupancy.

Ohio Department of Commerce

Special Inspection Statement

Project applicant:

Name of Applicant:

MICHAEL DUKET

Name of Company:

DUKET ARCHITECTS PLANNERS

Signature:



Date:

2.22.23

Property Owner:

Name of Owner:

MARTY SUTTER, CEO, PRESIDENT

Name of Company:

GENOA BANK

Signature:



Date:

2-22-2023

Revised 04/02/2019

SECTION 014500
QUALITY CONTROL

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. References.
- C. Manufacturers' field services and reports.

1.02 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 fully 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 a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.03 REFERENCES

- A. Conform to reference standard by date of issue current on date of Contract Documents.
- B. Obtain copies of standards when required by Contract Documents.
- C. Should specified reference standards conflict with Contract Documents, request clarification for Architect/Engineer before proceeding.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- B. 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 balance of equipment as applicable, and to initiate instructions when necessary.

- C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Utilities.
- B. Temporary Controls: Barriers, protection of the Work.
- C. Construction Facilities: Progress cleaning.

1.02 UTILITIES

- A. The Contractor shall provide and maintain ALL utilities for construction operations.
- B. The Contractor shall provide and maintain potable water for use during the course of construction.
- C. The Contractor shall provide and maintain temporary toilet facilities for use during the course of construction
- D. The Contractor shall provide and maintain temporary heating for areas of construction during the construction process.

1.03 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Maintain safe egress from the site during the entire construction period.

1.04 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 minimize damage.
- C. Protect finished surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials, or as appropriate for the condition and work to be performed. Any and all finished flooring damaged during construction will be required to be replaced to the satisfaction of the Owner and Architect at the cost of the offending Contractor.

1.05 SECURITY

- A. Provide security to protect Work from unauthorized use, vandalism, or theft.

1.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish daily. 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. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.

END OF SECTION

SECTION 017000
CLOSEOUT PROCEDURES

1. PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 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 inspection.
- B. Provide submittals to Architect/Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Submit certification that system installation is complete, that appropriate testing has occurred, and that all segments of the system, both new and existing, are operating properly.

1.03 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean equipment and fixtures to a sanitary condition.
- C. Clean site; sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.04 ADJUSTING

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

1.05 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Contract Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other Modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. 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.
- E. Record Documents 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.
- F. Delete Architect/Engineer title block and seal from all documents.
- G. Submit documents to Architect/Engineer with claim for final Application for Payment.
- 1.06 OPERATION AND MAINTENANCE DATA
- A. Submit one hard copy and one digital set prior to final inspection, bound in 8-1/2 x 11 inch text pages, three D side ring capacity expansion 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 as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.
- E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
- F. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
1. Significant design criteria.
 2. List of equipment.
 3. Parts list for each component.
 4. Operating instructions.
 5. Maintenance instructions for equipment and systems.

6. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
 - G. Part 3: Project documents and certificates, including the following:
 1. Shop drawings and product data.
 2. Air and water balance reports.
 3. Certificates.
 4. Photocopies of warranties and bonds.
 5. Waiver of Lien from Contractor and all Subcontractors.
 6. Final wage reports from Contractor and all Subcontractors.
 - H. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.
 - I. Submit final volumes revised, within ten days after final inspection.
- 1.07 WARRANTIES
- A. Provide one hard copy and one digital copy copy.
 - B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
 - C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.
 - D. Submit prior to final Application for Payment.
 - E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- 1.08 SPARE PARTS AND MAINTENANCE MATERIALS
- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
 - B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 017500
STARTING AND ADJUSTING

1. PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner 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, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative and Contractors' personnel in accordance with manufacturer's 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 that equipment or system has been properly installed and is functioning correctly.

1.03 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment and Instruct in a classroom environment located at the Project and instructed by a qualified manufacturers' representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. 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.

- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.
- F. Provide record document in front end of maintenance manual showing dates and participants for Demonstration and Instruction.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- H. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.04 TESTING, ADJUSTING, AND BALANCING

- A. Contractor will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balancing.
- B. The independent firm will perform services specified in Mechanical Specifications.
- C. Reports will be submitted by the independent firm, through the Contractor, to the Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

2. PART 2 PRODUCTS

Not Used.

3. PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 023000

SUBSURFACE INVESTIGATION

1. PART 1 GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 SUBSURFACE INVESTIGATION

- A. Information Not Guaranteed: Information on the Drawings and in the Project Manual relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.
- B. Foundation Engineering Report: Refer to the Geotechnical Report in the Appendices.

1.03 CONFIRMATION OF GRADES AND UTILITIES

- A. Prior to commencement of site excavating operations, the Contractor shall compare existing site grading and proposed new site grading. Where existing utilities are indicated but their inverts or depths are not, exploratory excavating shall be performed to assure that sufficient earth coverage will be attained during the course of new site grading.
 - 1. Utilities existing on the site shall be carefully protected from damage and relocated or removed as required by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings and the Architect, Owner and the utility owner notified in writing.
- B. If exploratory excavating confirms that the depth of existing utilities will be negatively impacted by proposed new grades (i.e., will be too shallow or become exposed), immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

1.04 CONFIRMATION OF INTEGRITY OF ADJACENT STRUCTURES

- A. Prior to commencement of site excavating operations, the Contractor shall compare foundation depths of existing structures and proposed depths of new utilities. Where existing structures are indicated but their foundation depths are not, exploratory excavating shall be performed to assure that proposed new excavations adjacent to them, or in near proximity of them, will not undermine the structural integrity of the existing structures.
- B. If exploratory excavating confirms that the footing depths of existing structures may be negatively impacted or undermined by proposed new excavations, immediately notify the Architect and the Owner. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

2. PART 2 PRODUCTS [Not Used]

3. PART 3 EXECUTION [Not Used]

END OF SECTION

SECTION 024119
SELECTIVE DEMOLITION

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of designated construction.

1.02 DESCRIPTION OF WORK

A. Work Included:

1. Demolition and removal of selected portions of buildings and structures and as required for new work. Refer to the Drawings for additional requirements.
 - a. Site demolition and removal of selected site elements and as required for new work.
2. Salvage of existing items to be reused or turned over to the facility.
3. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at her/his expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
4. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
5. Scheduling and sequencing operations without interruption to utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner. Provide temporary services as necessary to serve occupied and usable facilities when permanent utilities must be interrupted, or schedule interruption when the least amount of inconvenience will result.

1.03 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 the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.
- 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.

1.04 MATERIALS OWNERSHIP

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

1.05 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
 - 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 occupants 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.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.
- C. Predemolition Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01. Submit before Work begins.
- D. Landfill Records: Provide trip tickets (receipts) indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.
- B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- C. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- E. Standards: Comply with ANSI A10.6 and NFPA 241.
- F. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. 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.

1.07 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.

2. PART 2 PRODUCTS

2.01 SALVAGING

- A. Salvaged for Reinstallation: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and reinstalled shall be carefully removed and stored at a location acceptable to the Architect and Owner. Materials to be salvaged include, but are not limited to the following:
 1. As indicated on Drawings and as designated in the field.
- B. Salvaged for Storage: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and stored shall be carefully removed and delivered to the Owner at locations determined by Owner. Materials to be salvaged include, but are not limited to the following:
 1. As indicated on Drawings and as designated in the field.

3. PART 3 EXECUTION

3.01 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 registered in the state that the project is located 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 videotapes.
 1. 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.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. 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. Arrange to shut off indicated utilities with utility companies and Owner.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.
 - 4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Suppression, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.
 - 5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

3.03 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
 - 2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.
- B. 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.
 - 2. Remove temporary shoring, bracing and structural supports when no longer required.
 - 3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
- D. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

3.04 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 fire watch and 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.
- 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 storage area designated by the 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.
- E. Items for Re-use and Preservation of Existing Surfaces to Remain:
1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.
 2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.05 PROTECTION OF PUBLIC AND PROPERTY

- A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.
- B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.
- C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.
- D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.
- E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.
- F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.06 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.07 CUTTING

- A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.
- B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.

3.08 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Comply with requirements of as follows:
 - 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.
- B. Burning: Do not burn demolished materials.

3.09 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

1. PART 1 GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Slabs-on-grade.
 - 2. Curbs at building, doors, and islands.
 - 3. Housekeeping pads.
 - 4. Footings.
 - 5. Grade walls.
 - 6. Supported slabs.

1.02 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.

1.03 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.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Fiber reinforcement.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Semirigid joint filler.
 - 12. Joint-filler strips.
 - 13. Repair materials.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.

- G. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- H. Field quality-control reports.

1.04 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: The Owner will engage and pay for 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-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5
 - 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.
- H. Coordinate Special Inspection requirements and scheduling with Statement of Special Inspections in Section 014000 and Special Inspector.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

2. PART 2 PRODUCTS

2.01 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. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- E. 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.
- F. 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. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.03 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

- E. 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.04 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. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.05 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.

2.06 VAPOR BARRIER

- A. Sheet Vapor Barrier: ASTM E 1745 Class A, with vapor permeance of 0.01 gr/Ft/hr or less per ASTM E 96 or ASTM F 1249. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Stego Industries, LLC; Stego Wrap, 15mils.
 - b. W.R. Meadows; Perminator, 15mils.
 - c. ISI Building Products; Viper II, 15mils.
- 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.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and

manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.07 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; AQUA KURE - CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - l. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.

- n. SpecChem, LLC; Spec Rez Clear.
- o. Symons by Dayton Superior; Resi-Chem Clear.
- p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
- q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.08 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.09 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 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, 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.

2.10 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.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.

4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. 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.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, 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.

3. PART 3 EXECUTION

3.01 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 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. 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. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 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."
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Install dovetail anchor slots in concrete structures as indicated.

3.03 VAPOR BARRIER

- A. Sheet Vapor Barrier: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

3.04 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/D 1.4M, 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.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.05 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. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action 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. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.06 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. Scream 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.

3.07 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.

- 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.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, 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 one direction.
- 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 restraighening until surface is left with a uniform, smooth, granular texture.
- 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, 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.

3.09 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. 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.

3.10 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. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 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.

3.12 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 to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar 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.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
- C. 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 one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 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 field 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 do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION

SECTION 034500

PRECAST ARCHITECTURAL CONCRETE

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of architectural precast concrete is shown on drawings and by provisions of this section.
- B. Types of architectural precast concrete units required include the following:
 - 1. Precast concrete belt courses.
 - 2. Precast concrete base at building corners.
 - 3. Precast concrete cap at screen wall and dumpster enclosure.

1.02 SYSTEM PERFORMANCE

- A. General: Provide fabricator's architectural precast concrete adapted to applications indicated that comply with performance requirements specified and with applicable requirements of Building Code.
- B. Structural Performance: Design, engineer, fabricate and install architectural precast concrete units to withstand design loads indicated and required, to withstand building movement and accommodate deflections due to thermal variation, loading or other causes, and to resist in-service use conditions that architectural precast concrete units will experience including exposure to weather. Establish design of steel reinforcing, concrete mixes and connections for design loads and stresses within the following conditions and limitations:
 - 1. Gravity Loads:
 - a. Dead Loads: Actual weight of pre-cast members plus weight of superimposed panels, aluminum window wall, etc.
 - 2. Wind Loads:
 - a. As required by code.
 - 3. Seismic Loads:
 - a. As required by code.
- C. Design and Engineering Responsibility: Manufacturer/fabricator shall assume undivided responsibility for design and engineering architectural precast concrete units and connections including employing a Registered Professional Engineer specializing in structures licensed in State of Ohio to prepare complete design calculations, shop drawings and other structural documentation. Precast sections must be designed to span distances required over storefront framing, drive-up window, and other nonstructural elements shown on Drawings. Joints shall be as shown on Drawings.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except as otherwise indicated.
 - 1. ACT 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 3. AC1311 "Recommended Practice for Concrete Inspection".
 - 4. AC1 315 "Manual Standard Practice for Detailing Reinforcing Concrete Structures".
 - 5. ACT 318 "Building Code Requirements for Reinforced Concrete".
 - 6. ACI 347 "Recommended Practice for Concrete Formwork".

7. ACT 503R "Use of Epoxy Compounds with Concrete".
 8. ACI 548.1R "Guide for the Use of Polymers in Concrete".
 9. CRSI "Manual of Standard Practice".
 10. PCI MNL 116 "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products".
 11. PCI MNL 117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products".
 12. PCI MNL 120 "Design Handbook —Precast and Prestressed Concrete".
 13. PCI MNL 122 "Architectural Precast Concrete".
 14. Current Ohio Building Code.
- B. Fabricator Qualifications: Firm with not less than 5 years successful experience in fabrication of architectural precast concrete units similar to those required for this project with record of successful in-service performance and with sufficient production capacity to produce required units without delaying the work.
1. Fabricator must be producer member of Precast/Prestressed Concrete Institute (PCI) and be designated a PC1 Certified Plant for Production Group A, Category A1.
- C. Professional Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation and successful in-service performance of architectural precast concrete units similar to this Project in material, design and extent.
1. Professional Engineer must provide and maintain professional liability insurance in the amount of not less than \$1,000,000 for the duration of design services extending not less than 3 years after date of Project Final Acceptance.
- D. Erector Qualifications: Minimum of 5 years successful experience in erection of architectural precast concrete units similar to those required for this project and with record of successful in-service performance.
- E. Design concept modifications may be made only as necessary for field conditions, to ensure proper fitting of the work and to comply with design requirements as acceptable to Architect. Maintain general design concept shown without increasing or decreasing member sizes and modules or altering pattern configurations shown.
- F. Welding Standards: Comply with applicable provisions of AWS D 1.1 "Structural Welding Code Steel" and AWS D1.4 "Structural Welding Code Reinforcing Steel".
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- G. Calculated Fire-Test-Response Characteristics: When fire-resistance-rated assemblies are indicated, provide architectural precast concrete units whose calculated fire resistance has been determined according to ASTM E 119 and PCI MNL-124 "Design for Fire Resistance of Precast Prestressed Concrete" and is acceptable to authorities having jurisdiction.
- H. Field Constructed Mockups: Prior to completing shop drawings and fabrication of architectural precast concrete units, construct mockups and erect in field. Incorporate all features of system as part of mockups as shown on drawings after acceptance of shop drawings for mockups by Architect. Purpose of mockups is further verification of selections made for patterns, color and texture under sample submittals and to establish standard of quality for aesthetic effects expected in completed work.
1. Construct full size mockups for areas selected by Architect.
 2. Build mockups using same materials, mix design and fabrication procedures as proposed for Project. Repair, reconstruct or replace any architectural precast concrete units not acceptable to Architect,
 3. Locate mockups on site in location as directed by Architect.
 4. Notify Architect one week in advance of the date and time when mockups will be erected.
 5. Obtain Architect's acceptance of mockups before completing final shop drawings.

6. Maintain mockups in undisturbed condition during construction as standard for judging completed precast work.
 - a. Final mockups may be incorporated in project installation if acceptable to Architect.
- I. Coordination Conferences: Conduct conferences prior to 1) fabricating field constructed mockups, 2) fabrication of architectural precast concrete units for Project, 3) commencing erection of architectural precast concrete units, and additionally as required. Meet at project site with Fabricator, Erector, installer of each component of associated work, installers of work which must precede or follow architectural precast concrete, and other representatives directly concerned with performance of the work including Design Engineer, testing laboratory, governing authorities, Architect and Owner. Record (Contractor) discussions of conferences and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to architectural precast concrete including, but not necessarily limited to the following:
 1. Architectural precast concrete requirements (Drawings, Specifications and other Contract Documents).
 2. Required submittals, both completed and yet to be completed.
 3. Status of field constructed mockups.
 4. Status of design mix submissions.
 5. Status of fabricated materials and products required for precast concrete system.
 6. Review proposed scheduling and sequencing of material deliveries including traffic routes, on-site and off-site staging, crane locations, and potential impact on adjacent roads such as traffic lane closures.
 7. Availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 8. Required testing, inspection and certifying procedures.
 9. Forecast weather conditions and procedures for coping with unfavorable conditions.
 10. Regulations concerning code compliance, health, safety, fire, traffic and similar considerations.
 11. Procedures required for protection of architectural precast concrete during remainder of construction period.
 12. Procedures required for protection of adjoining structures, streets, walks and pedestrian routes.

1.04 SUBMITTALS

- A. Preconstruction Services, Concept Drawings: Within two (2) weeks of Notice of Award, submit Concept Drawings indicating proposed system elements, proposed typical sizes, and proposed typical standard connections. Include the following minimum information:
 1. Proposed thickness of non-load bearing spandrel panels, in-fill panels and wall panels indicating limitations on depth and location of reveals, Indicate minimum thickness and cover requirements to provide compliance with specified fire resistance ratings. Include proposed horizontal and vertical joint locations,
 2. Proposed sizes of column cover panels. Include proposed splice locations. Include proposed dimensions indicating typical bearing details. Indicate minimum thickness and cover requirements to provide compliance with specified fire resistance ratings.
 3. Proposed typical standard connections including type and size of bearing pads and the general location and type of connection hardware:
 - a. Spandrel panel bearing details for spandrels bearing on floor beams, and for in-fill panels bearing on spandrels.
 - b. Wall panel connections at both vertical and horizontal joints for solid panels.
 - c. Column cover support details at both load bearing supports and lateral tie-back locations.
 - d. Foundation anchorage details for all types of precast concrete elements indicating typical size, spacing and quantity of anchor bolts, embedded plates and angles, grout pad thicknesses, recesses and pockets, etc.
- B. Preconstruction Services, Mix Designs and Samples: Within two (2) weeks Notice of Award,

submit preliminary proposed mix designs and samples indicating potential color range and textures for Architect's review. It is intended that project specific samples will be fabricated for final review and selection following this preliminary submittal.

- C. Preconstruction Services, Pre-Construction Drawings: After acceptance of Concept Drawings and prior to preparation of Shop Drawings, submit Pre-Construction Drawings which will establish the basis for erection drawings. Do not proceed with Shop Drawings prior to final acceptance unless otherwise acceptable to the Architect. Include the following minimum information:
 - 1. Final layouts for all belt course sections. Include all joint locations, dimensions and thicknesses. Identify all reveals including sizes and locations.
 - 2. Final arrangement and layout of typical connections showing size and location of seats, type and size of bearing pads, type of material and finish, etc. It is understood that all submitted details will be subject to final engineering design.
 - 3. Final control drawing for foundation detailing, including size and location (plan and elevation) of cast ledges, pockets, embedded items, anchor bolts, etc.
- D. Preconstruction Services, Engineering Calculations: Prior to preparation of Shop Drawings, submit Pre-Construction Engineering Calculations. Do not proceed with Shop Drawings prior to final acceptance unless otherwise acceptable to the Architect. Include the following minimum information:
 - 1. Determination of typical dead loads, live loads (if applicable), wind loads and seismic loads in accordance with the referenced design codes.
 - 2. Sample column cover panel calculations indicating adequacy of proposed sizes. Include sample bearing support reinforcing, lateral connections and splice connection calculations.
 - 3. Sample spandrel panel calculations for panels supporting curtainwall and for panels supporting in-fill panels. Include sample bearing support and lateral connection calculations.
 - 4. Sample calculations for typical solid wall panels. Include sample bearing support and lateral connection calculations.
- E. Product Data: Submit fabricator's specifications, data and instructions for manufactured materials and products. Include mix designs, certifications and laboratory test reports as required.
 - 1. Include water absorption test reports for units with exterior exposure.
- F. Shop Drawings: Submit shop drawings prepared under supervision of Registered Professional Engineer showing complete information for fabrication and installation of architectural precast concrete units. Indicate member dimensions and cross-sections; fabrication tolerances; location, size and type of reinforcement including special reinforcement; architectural concrete facing including surface patterns, details of patterns, wrap around edge treatment and extent of finish; and lifting devices necessary for handling and erection.
 - 1. Initially submit shop drawings for field constructed mockups, revising until acceptance.
 - 2. After acceptance of field constructed mockup shop drawings and acceptance of field constructed mockups, prepare and submit shop drawings for architectural precast concrete required for entire project.
 - 3. Indicate separate face and back-up mix locations and thickness.
 - 4. Provide layout, dimensions and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail loose, cast-in and field hardware, inserts, connections and joints including accessories and construction at openings in architectural precast concrete units.
 - 5. Indicate location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placements.

6. Provide complete design calculations prepared by a Registered Professional Engineer licensed in State of Ohio.
- G. Samples for Verification Purposes: Submit samples of architectural concrete facing approximately 24 inches square x 2 inches thick to illustrate quality, patterns, color and texture of surface finish. Where normal color and texture variations are to be expected, include 2 or more units in each set of samples showing limits of such variations.
 1. Initially submit samples prior to fabrication of field constructed mockups.
 2. Submit additional samples prior to production fabrication.
- H. Design Mixes: Submit design mix for each concrete mix, and revised mix proportions when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- I. Welder Certificates: Submit welder certificates signed by Contractor certifying that welders comply with specified AWS "Qualification" requirements.
- J. Material Test Reports: Submit material test reports from a qualified independent testing agency evidencing compliance with specified requirements for the following based on comprehensive testing of current materials:
 1. Concrete materials.
 2. Reinforcing materials.
 3. Prestressing strands.
 4. Admixtures.
 5. Bearing pads.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver architectural precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store and handle units to prevent cracking, distortion, warping, staining or other physical damage and so that markings are visible.
- B. Lift and support units only at designated lifting and supporting points as shown on final shop drawings.
- C. Deliver anchorage items that are to be embedded in other construction before starting such work. Provide setting diagrams, templates, instructions and directions as required for installation.

2. PART 2 PRODUCTS

2.01 FORMWORK

- A. Provide forms and, where required, form facing materials of metal, plastic, wood or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.
- B. Accurately construct forms to be mortar tight of sufficient strength to withstand pressures due to concrete placing operations, temperature changes and for prestressing, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines and dimensions indicated within fabrication tolerances specified.
- C. Design forms so that stresses are not included in precast units when forms are stripped prior to detensioning due to deformation of concrete under prestress or movement during detensioning.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed except where welded comply with ASTM A 706, Grade 60.
 - 1. Epoxy Coated Reinforcing Bars: ASTM A 775.
- B. Welded Wire Fabric: ASTM A 185,
 - 1. Epoxy Coated Welded Wire Fabric: ASTM A 884, Class A.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing,
 - 1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRS', Class 2) except provide only stainless steel where architectural facing.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III.
 - 1. Use only one brand, type, and source of supply of cement throughout the project, unless otherwise acceptable to Architect.
 - 2. Cement must produce exposed to view color acceptable to Architect. Use gray and/or white cement with or without pigment as required.
- B. Aggregates:
 - 1. General: ASTM C 33 with coarse aggregates complying with Class 55 requirements. Provide each type of aggregate used from a single source.
 - a. Local aggregates not complying with ASTM C 33, but which have shown by special test or actual service to produce precast concrete of adequate strength and durability may be used when acceptable to Architect.
 - b. Do not use aggregates containing soluble salts or other substances such as iron sulphides, pyrite, marcasite or ochre which can cause stains on exposed precast concrete surfaces.
 - 2. Fine Aggregates: Clean, sharp, natural sand free from loam, clay lumps or other deleterious substances.
 - a. For architectural concrete facing mix use aggregate to provide appearance matching Architect's control samples when finished.
 - 3. Coarse Aggregates: Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter.
 - a. For architectural concrete facing mix use aggregate to provide appearance matching Architect's control samples when finished.
- C. Pigments: Nonfading, resistant to lime and other alkalies, and types as required to provide appearance matching Architect's sample when finished.
- D. Water: Potable, free of deleterious materials that may affect color stability, setting or strength of concrete or be harmful to embedded steel.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Water-Reducing, Retarding or Accelerating Admixtures: ASTM C 494, Type as selected by Fabricator. Use only products by same manufacturer for each mix design and establish their compatibility.
- G. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

- H. Corrosion Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- I. Product/Manufacturer: DC1 or DCI-S; W.R. Grace.
- J. Bonding Agent and Anti-Corrosion Coating: Commercially formulated epoxy modified cementitious product which is both a bonding agent and provides anti-corrosion protection.
 - 1. Product/Manufacturer: Sika Armatec 110 EpoCem; Sika Corp.

2.04 CONNECTION MATERIALS

- A. Steel Shapes and Plates: ASTM A 36.
- B. Carbon Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- C. Carbon Steel Bolts and Studs: ASTM A 307, Grade A, regular low-carbon steel, hexagon head bolts and studs, nuts and flat, unhardened steel washers.
- D. High-Strength Threaded Fasteners: ASTM A 325, Type I, heavy hexagon structural bolts, heavy hexagon nuts and hardened washers, quenched and tempered medium-carbon steel.
- E. Welded Headed Studs: AWS D1.1, Type B headed studs, cold finished carbon steel bars.
- F. Welding Electrodes: Comply with AWS standards..
- G. Accessories: Provide clips, hangers, plastic shims and other accessories required to install project units and to support subsequent construction or finishes.
- H. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process, complying with the following requirements:
 - 1. ASTM A 123, Coating Grade 65 for galvanizing rolled, pressed and forged shapes, plates, bars and strips.
 - 2. ASTM A 153 for galvanizing iron and steel hardware.
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.05 BEARING PADS

- A. Provide bearing pads as follows and as required by design:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 shore A durometer, minimum 2250 psi tensile strength as determined by ASTM D 412.
 - 2. Random, Fiber Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer, 70 to 90 Shore A durometer surface hardness,
 - 3. Frictionless Pads: Tetrafluoroethylene (TFE), glass fiber reinforced, bonded to stainless steel plate, type required for in-service stress.

2.06 GROUT MATERIALS

- A. Cement Grout: Portland cement, ASTM C 150, Type 1, and clean, natural sand, ASTM C 404. Mix at ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive,

nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 CONCRETE REPAIR MATERIALS

- A. Epoxy Adhesive: ASTM C 881, two component high strength low viscosity resin adhesive suitable for crack repair.
 - 1. Products: Subject to compliance with requirements, provide only the following: a. Sikadur 35 Hi-Mod LV LPL; Sika Corp.
- B. Bonding Agent and Admixture: Acrylic polymer latex, non-reemulsifiable. 1. Products: Subject to compliance with requirements, provide only the following: a. SikaLatex: Sika Corp.
- C. Patching Compound: Single component, factory packaged with graded aggregates and selected cements for use with specified admixture.
 - 1. Products: Subject to compliance with requirements, provide only the following: a. SikaRepair SHB: Sika Corp.

2.08 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel at precast fabricator's option.
- C. Proportion mixes by either laboratory trial batch or field experience methods using materials to be employed on the project for each type of concrete required complying with ACE 318.
- D. Exposed Architectural Concrete Facing Mix: Standard weight concrete consisting of specified Portland cement, fine and coarse aggregates, admixtures and water to produce the following properties:
 - 1. Compressive Strength: 5,000 psi minimum at 28 days.
 - 2. Total Air Content: Not less than 4 percent nor more than 6 percent.
 - 3. Appearance: Use Portland cement, pigment, coarse and fine aggregate which will match Architect's control samples when finished.
 - 4. Cure compression test cylinders using same methods as used for precast concrete work.
- E. Backup Mix: Standard weight concrete consisting of specified Portland cement, aggregates, admixtures and water to produce the following properties:
 - 1. Compressive Strength: 5,000 psi minimum at 28 days.
 - 2. Release Strength: 3,500 psi.
 - 3. Total Air Content: Not less than 4 percent nor more than 6 percent.
 - 4. Cure compression test cylinders using same methods as used for precast concrete work.
- F. Submit written reports to Architect for proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.
- G. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.
- H. Admixtures: Use air-entraining admixture in concrete unless otherwise indicated.
 - 1. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low- slump concrete may be used subject to Architect's acceptance.

2. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of casting. Adjust quantities of admixture as required to maintain quality control.
3. Use corrosion inhibiting admixture for all architectural precast units within 4 feet of grade. Use dosage of 6.0 gal. per cu. yd. in concrete mixes.

2.09 FABRICATIONS

- A. General: Fabricate architectural precast concrete units complying with manufacturing and testing procedures, quality control recommendations and dimensional tolerances of PCI MNL 117 and in this section.
- B. Formwork: Accurately construct forms mortar-tight and of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines and dimensions indicated, within fabrication tolerances specified in PCI IVINL 117 and in this section.
 1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formula form-coating compounds that will not bond with, stain or adversely affect concrete surfaces, and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturers instructions.
 2. Unless prestressed units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestressor movement during detensioning.
- C. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formula form-coating compounds that will not bond with, stain or adversely affect concrete surfaces, and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion.
- D. Built-In Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of the main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.
 1. Wrap edges of all embedded plates with thin layer of resilient material such as preformed foam sealant as required to prevent spalling of concrete at edges under localized conditions of high temperature such as welding.
- E. Cast-in reglets, slots, holes and other accessories in units to receive cramps, dowels, reglets, flashings and other similar work as indicated.
- F. Supply loose steel plates, clip angles, seat angles, anchors, dowels, cramps and other miscellaneous steel shapes not provided by other trades, necessary for securing architectural precast concrete units to supporting and adjacent members.
- G. Cast in openings larger than 10 inches in any dimension according to final shop drawings. Other smaller holes may be field cut by trades requiring them as acceptable to Architect.
- H. Reinforcement: Comply with recommendations of CRSI's "Manual of Standard Practice" for fabricating, placing and supporting reinforcement.
 1. Clean reinforcement of loose rust and mill scale, earth and other materials that reduce or destroy bond with concrete.
 2. Accurately position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers required.
 3. Place reinforcement to obtain not less than minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position

- while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace sides with wire, Offset laps of adjoining widths to prevent continuous laps in either direction.
 5. Use epoxy coated reinforcing materials for all architectural precast units within 4 feet of grade.
- I. Pretensioning: Pretension tendons for prestressed concrete either by single strand tensioning method or multiple tensioning method. Comply with PCI MNL 117 requirements.
 - J. Reinforce architectural precast concrete units to resist stresses resulting from handling, transportation, erection and in-service conditions and to minimize cracking. Provide 200 psi minimum P'restress after all losses unless otherwise acceptable to Structural Engineer and Architect.
 - K. Concrete Mixing: Comply with requirements and with ASTM C 94. Additionally comply with PCI MNL 117 for architectural concrete face mix. No additional water may be added following concrete batching.
 - L. Concrete Placement: Place concrete in a continuous operation to prevent seams or planes of weakness from forming in architectural precast concrete units. Comply with requirements of ACI 304R for measuring, mixing, transporting and placing concrete.
 1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with AC1 309R.
 2. Comply with AC1 306R procedures for cold weather concrete placement.
 3. Comply with ACI 305R procedures for hot weather concrete placement.
 - M. Identify pick-up points and orientation in structure with permanent markings, complying with markings indicated on final shop drawings. Imprint cast date on each precast unit on a surface that will not show in finished structure,
 - N. Cure by low pressure steam, steam vapor, radiant heat and moisture, or another similar process to accelerate concrete hardening and to reduce curing time according to requirements of PCI MNL 117.
 - O. Delay detensioning prestressed units until concrete has attained not less than 70 percent of its compressive strength as established by test cylinders cured under same conditions as architectural precast concrete.
 1. If concrete has been heat-cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - P. Fabricate architectural precast units straight, smooth, and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.
 1. Precast units which are warped, cracked, broken, spalled, stained or otherwise defective will not be acceptable.
 - Q. Surface Finish: Fabricate precast units and provide exposed surface finishes as follows:
 1. Exposed Architectural Concrete Finish: Use the following procedure to expose the coarse aggregate and surrounding matrix surfaces to match Architect's control samples.
 - a. Perform abrasive blasting within 24 to 72 hours after casting. Coordinate with structural precast fabrication including concrete placement and formwork removal to ensure that surfaces to be blast finished are blasted at same age for uniform results.
 - b. Perform abrasive blast finishing in as continuous an operation as possible, utilizing

- same work crew to maintain continuity of finish on each surface or area of work.
- c. Use an abrasive grit of proper type and graduation to expose aggregate and surrounding matrix surfaces to produce a light cut exposing fine aggregate with occasional exposure of coarse aggregate with maximum 1/16 inch reveal and matching accepted samples.
 - 1) Where alternate heavy abrasive blast finish at reveals, use an abrasive grit of proper type and graduation to expose aggregate and surrounding matrix surfaces to reveal coarse aggregate to a maximum projection of one-third its diameter with a reveal range of 1/4 to 1/2 inch.
 - d. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match Architect's samples.
 - e. After abrasive blasting to required depth is completed, apply a weak, acid wash to clean abrasive-blasted surfaces to match Architect's sample and field constructed mockup. Thoroughly neutralize and flush acid from surfaces with water under pressure.
2. Other Surfaces: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycomb or structural defects will not be permitted.
- R. Where ends of strands will not be enclosed or covered, cut flush and cover with specified bonding agent and anti-corrosion coating as recommended by manufacturer.
- S. Dimensional Tolerances of Finished Units: Overall height and width measured at face adjacent to mold at time of casting:
- 1. 10 feet or less: Plus or minus 1/8 inch.
 - 2. 10 feet or 20 feet: Plus 1/8 inch, minus 3/16 inch.
 - 3. Angular deviation of plane of side mold: 1/32 inch per 3 inches depth, or 1/16 inch total, whichever is greater.
 - 4. Openings within one unit: Plus or minus 1/4 inch.
 - 5. Out of square (difference in length of two diagonal measurements): 1/8 inch per 6 feet or 1/4 inch total, whichever is greater.
 - 6. Thickness: Minus 1/8 inch, plus 1/4 inch.
 - 7. Tolerances of other dimensions not otherwise indicated: Numerically greater of plus or minus 1/16 inch per 10 feet or plus or minus 1/8 inch.
- T. Position Tolerances: For cast-in items measured from datum line locations as shown on reviewed shop drawings:
- 1. Anchors and Inserts: Within 3/8 inch of centerline location.
 - 2. Blockouts and Reinforcements: Within 1/4 inch of position shown on shop drawings, where such positions have structural implications or affect concrete cover; otherwise within plus or minus 1/2 inch.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine supporting structure and conditions under which architectural precast concrete units are to be erected. Notify General Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with installation until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 INSTALLATION

- A. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.
- B. Do not install architectural precast concrete units until concrete has attained its design compressive strength.
- C. Install clips, hangers and other accessories required for connecting architectural precast concrete units to supporting members and back-up materials.
- D. Install bearing pads as architectural precast concrete units are being erected. Set pads on true, level and uniform bearing surfaces and maintain in correct position until structural precast concrete units are placed.
 - 1. Use elastomeric bearing pads not less than 1/2 inch thick by 5 inches wide where precast members bear on masonry, precast members or structural steel.
 - a. Use random fiber reinforced elastomeric pads under all areas of high bearing stress.
 - 2. Use frictionless bearing pads at building expansion joints.
 - 3. Set all bearing pads not less than 1/4 inch back from edge of supported and supporting members.
 - a. Glue pads in position to maintain location during erection.
- E. Lift, place and secure architectural precast units in accordance with manufacturer's printed instructions and final shop drawings. Keep units tight and perpendicular to bearing supports. Do not install architectural precast units until supporting members are in place and secured.
- F. Install architectural precast concrete members plumb, level and in alignment within PCI MNL 117 and specified limits of erection tolerances. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently supported and anchored.
- G. Anchor architectural precast units in final position by bolting, welding, grouting or as otherwise indicated. Remove temporary shims, wedges and spacers as soon as possible after anchoring is completed.
- H. Welding: Perform welding in compliance with AWS 1)1.1 and AWS D1.4 with qualified welders.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - 2. Repair damaged steel surfaces by applying galvanizing repair coating.
- I. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.
- J. Do not use powder actuated fasteners for attaching accessory items to precast concrete surfaces.
- K. Do not cut reinforcing or prestressing strands without approval of manufacturer.
- L. Grout connections and joints where required or indicated including open spaces at keyways, connections and joints. Retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.03 ERECTION TOLERANCES

- A. Warpage: Fabricate and install wall panels so that each panel after erection complies with the

following dimensional requirements:

1. Bowing (concave or convex) of any part of a flat surface not to exceed length of bow/360 with a maximum of $\frac{1}{8}$ inch up to 30 feet.
 2. Maximum warpage of one corner out of plane of other three; the greater of $\frac{1}{16}$ inch per foot distance from nearest adjacent corner, or $\frac{1}{8}$ inch.
- B. Tolerances for Location of Precast Units: Fabricate and erect precast units so that joints between panels meet the following:
1. Face width of joints: Plus or minus $\frac{3}{16}$ inch.
 2. Joint taper: $\frac{1}{4}$ inch per foot length, with maximum length of tapering in one direction of 10 feet.
 3. Step in face: $\frac{1}{4}$ inch.
 4. Jog in alignment of edge: $\frac{1}{4}$ inch.
 5. Alignment for exterior panels is outside face.
 6. Variation from plumb: Plus or minus $\frac{1}{4}$ inch in any 40 foot run.
 7. Variation from level: Plus or minus $\frac{1}{4}$ inch in any 40 foot run.

3.04 REPAIRS

- A. Repair exposed to view architectural precast concrete unit surfaces to match color, texture and uniformity of surrounding concrete when permitted by Architect.
- B. Crack Repair: Use only specified epoxy adhesive repair material, and comply with manufacturer's instructions for mixing and injecting epoxy. Install injection ports, surface sealers and other required preparation. After epoxy has cured remove ports, surface sealers and any other exposed preparations. Provide finish surface flush with adjacent precast concrete with same color and texture. Patch as required.
- C. Spall Repair: Use only specified patching compound and bonding agent and admixture. Comply with manufacturer's instructions for mixing, preparation and application.
1. Trim edges of spalled areas to provide not less than $\frac{1}{2}$ inch depth at approximately right angle to surface. Do not feather edges. Maintain straight perimeter edges wherever possible, and configure patched areas in compact, contiguous rectilinear shapes.
 2. Prepare entire area where patching required to remove contaminants, loosely bonded aggregate and to expose sound concrete surface. Use wire brushes, compressed air and abrasive or water blasting procedures as necessary.
 3. Mix and apply patching compound and admixture as recommended by manufacturer. Trowel apply as required to match adjacent texture and configuration to provide flush surfaces in true planes and sharp, straight edges aligning with adjacent surfaces.
 4. Fill repair areas with patching compound, and do not feather edges. Finish patched areas to match texture of and be flush with adjacent concrete surfaces except where architecturally exposed finish.
- D. Surface Repair Where Architecturally Exposed Finish: Thoroughly clean, dampen with water and brush-coat area to be repaired with specified bonding agent. Place job mixed patching mortar using same mix as for exposed architectural finish before bonding compound has dried.
1. Mix and apply dry-pack mortar using only enough water as required for handling and placing. Do not feather edges. Compact mortar in place. Strike-off slightly higher than surrounding surface and apply finish as required to match adjacent texture and configuration to provide flush surfaces in true planes and sharp, straight edges aligning with adjacent surfaces.
 2. Protect concrete mortar from premature drying and excessive cold or hot temperatures. Cure concrete mortar after placing and finishing, keeping continuously moist for not less than 7 days.
- E. Remove and replace damaged architectural precast concrete units when repairs do not meet

requirements.

1. Limitations as to amount of patching which will be permitted is subject to acceptance of Architect.

3.05 CLEANING

- A. Clean exposed surfaces after erection to remove weld marks, other markings, dirt and stains.
 1. Wash and rinse in accordance with precast manufacturer's recommendations, Protect other work from damage due to cleaning operations.
 2. Do not use cleaning materials or processes which could change the character of exposed precast finishes.

3.06 ACCEPTANCE REQUIREMENTS

- A. Conduct inspections, perform testing and make repairs or replace unsatisfactory architectural precast concrete units as required.
- B. In addition to above, in-place architectural precast concrete units may be rejected for any one of the following:
 1. Exceeding specified installation tolerances.
 2. Damage during construction operations.
 3. Exposed-to-view surfaces which develop surface finish deficiencies including cracking.
 4. Other appearance defects as listed in PCI MNL 117.

END OF SECTION

SECTION 042000

UNIT MASONRY SYSTEMS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Concrete masonry units.
 2. Face brick.
 3. Embedded flashing.
 4. Mortar and grout.
 5. Reinforcing steel, masonry joint reinforcement, ties and anchors.

1.02 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. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. Samples for Verification: For each type and color of the following:
1. Exposed concrete masonry units.
 2. Face brick, in the form of straps of five or more bricks.
 3. Pigmented 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.
- D. Qualification Data: For testing agency.
- E. 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. 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.
- F. 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.
- G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.03 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.
- 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: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
1. 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.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.
1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
 2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 3. Protect approved sample panels from the elements with weather-resistant membrane.
 4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.04 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.

1.05 PROJECT CONDITIONS

- A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.
- B. 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 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 down face next to unconstructed wythe and hold cover in place.
- C. 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.
- D. 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.
- E. 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 and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

2. PART 2 PRODUCTS

2.01 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 use 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.

2.02 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.
- B. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2.03 BRICK

- A. Face Brick: ASTM C 216, Grade SW, Type FBS.
 - 1. Trade Reference and Color: **Belden Modular Alaska White Velour A.**
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. 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."
- B. Building (Common) Brick where Concealed: ASTM C 62, Grade SW.
- C. 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.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 5. Units which are sawn and less than one-half full size shall not be used.

2.05 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 to match existing installation as identified by the Architect
- B. Hydrated Lime: ASTM C 207, Type S.
- C. 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. LanXess; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
 - 2. Color:
 - a. **White, Type N.**

- D. Aggregate for Mortar: ASTM C 144. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- E. Aggregate for Grout: ASTM C 404.
- F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:
 - 1. Addiment Incorporated, a Div. of Grace Construction Products; Mortar Tite.
 - 2. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - 3. BASF Construction Chemicals; MasterPel Mortar Admixture.
- G. Water: Potable.

2.06 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- 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 and Spacing: As required by Code.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.07 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with 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 zinc coating.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 6. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- C. Partition Top Anchors: 0.097-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- D. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.
- E. Adjustable Masonry-Veneer Anchors: 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, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

1. Screw-Attached, Masonry-Veneer Anchors: Units, equal to Pos-I-Tie Brick Veneer Anchoring System by Heckmann Building Products Inc., consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Zinc-alloy barrel section with flanged head with wing-nut eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
2. Screw-Attached, Masonry-Veneer Anchors: Units equal to HB-213 Adjustable Veneer Anchor by Hohmann & Barnard, Inc., consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Rib-stiffened, sheet metal plate with 9/32 inch diameter screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes with 1-1/4 inch maximum allowable eccentricity, sized to prevent in-and-out movement beyond allowable tolerances, for inserting vertical legs of wire tie specially formed to fit anchor section.
 - b. Wire Ties: Rectangular-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
3. Screw-Attached, Masonry-Veneer Anchors: Units equal to DW-10-X Veneer Anchoring System by Hohmann & Barnard, consisting of a wire tie and a metal anchor section:
 - a. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, steel sheet, galvanized after fabrication.
 - c. Wire Ties: Triangular wire ties fabricated from 0.25-inch-diameter, hot-dip galvanized steel wire.

2.08 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.09 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 - SHEET METAL FLASHING AND TRIM and as follows:
 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 2. Configuration: Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. See drawings for profiles required.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 - SHEET METAL FLASHING AND TRIM.
- 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. Verify compatibility between flashing materials and substrates.

- D. Transition Strips: Provide long-term compatible 6 inch wide transition strips to seal embedded flashing terminations to air barrier membrane. Comply with requirements of section 072700 – AIR BARRIERS.
- E. Drip Edge: Provide type 316, 0.016 inch (0.40 mm) thick stainless steel drip edge plates with factory applied adhesive strip for all through-wall flashing conditions. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom sizes will be required see drawings for profiles required.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings or equivalent. Available products:
 - 1. Advanced Building Products Inc.; Mortar Break II.
 - 2. Archovations, Inc.; CavClear Masonry Mat.
 - 3. Hohmann & Barnard, Dur-O-Wal Division; Polytite Mortar Stop.
 - 4. Mortar Net USA, Ltd.; Mortar Net.

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.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to

provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 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.
- C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with 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 as measured according to ASTM C 143/C 143M.

3. PART 3 EXECUTION

3.01 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 and other substrates are within tolerances specified.
- 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.

3.02 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. Do not use units cut to less than one-half size.
- E. Do not install concrete masonry units with more than 5 percent damage to the face. Do not install brick units which will show defects after installation.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

- G. 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, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch 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, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.03 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 bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Architect.
- C. 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.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. 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 clearance between end of anchor rod and end of tube. Space anchors 48 inches 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.

3.04 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and 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. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.05 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 - 2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Coordinate and allow access for air and vapor barrier membrane installed in cavity under Section 072700 - AIR BARRIERS.

3.06 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.07 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.08 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through insulation and sheathing to wall framing and to concrete and masonry backup as applicable with metal fasteners of type indicated.
 - 2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as required by Code.

3.09 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
 - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 - 3. Build in compressible joint fillers where indicated.
 - 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 - JOINT SEALANTS.
- D. 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 Section 079200 - JOINT SEALANTS but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install galvanized steel lintels where indicated.

- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 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. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 - 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
 - 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 5. Install air barrier transition strips to seal embedded flashings in masonry to air barrier membrane in accordance with Section 072700 – AIR BARRIERS.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.
- E. 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. Space weep holes 24 inches o.c., unless otherwise indicated.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough

strength to resist grout pressure. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 FIELD QUALITY CONTROL

- A. Inspectors: Engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports. 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. of wall area or portion thereof. Test types as determined by the independent testing and inspection agency.

3.14 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, around penetrations and 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 non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 6. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 7. Clean stone and/or precast concrete trim to comply with supplier's written instructions.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

1. PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.

1.02 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings and other structural data for structural steel connections.

1.04 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. For structural-steel connections indicated to comply with design loads, include structural design data prepared, signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting

Applicators."

- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Coordinate Special Inspection requirements and scheduling with the Statement of Special Inspections in Section 014100, structural drawings and Special Inspector.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.07 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

2. PART 2 PRODUCTS

2.01 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. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: Standard, unless noted otherwise.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A 563, Grade C, (ASTM A 563M, Class 8S)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)**, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: **ASTM F 959, Type 325 (ASTM F 959M, Type 8.8)**, compressible-washer type with plain finish.

2.03 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.04 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, 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 SSPCSP 2, "Hand Tool Cleaning or 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/D1.1M and manufacturer's written instructions.
- G. 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 machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.

- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass 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. Baseplate 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.

2.06 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.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 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 (applied fireproofing).
 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."
 3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
 5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
 6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
 9. SSPC-SP 8, "Pickling."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPCPS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.08 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.09 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance or corrected Work with specified requirements.
- D. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. 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.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 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.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. 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 in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 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: 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/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M 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/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPCPA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.
1. Loose steel bearing and leveling plates, galvanized at exterior walls and locations.
 2. Galvanized steel lintels with shop-applied primer at exterior locations.
 3. Miscellaneous steel framing and supports:
 - a. Galvanized steel framing and supports for mechanical and electrical equipment.
 - b. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
 - c. Prefinished slotted steel channel support framing.
 4. Galvanized steel bollards with shop-applied primer.
 5. Metal cable supports and attachments.
 6. Counter and bench supports.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. 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.
- C. 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.

1.03 SUBMITTALS

- A. Product Data: For the following:
1. Manufactured products.
 2. Nonslip aggregates and nonslip-aggregate surface finishes.
 3. Paint products.
 4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Provide templates for anchors and bolts specified for installation under other Sections.
 3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.

- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.04 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 the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- C. 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."
- D. 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.

1.05 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.

1.06 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of 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.
- C. 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.

2. PART 2 PRODUCTS

2.01 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.
- E. 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.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
 - 1. Provide Schedule 80 pipe for bollards.
- H. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
- I. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.02 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221/221M, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.03 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. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. 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.

- D. 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. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- 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.

2.05 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, 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.

2.06 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.07 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, unless otherwise indicated.

2.08 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.

2.09 STEEL PIPE BOLLARDS

- A. Fabricate metal bollards from 4 inch diameter Schedule 80 steel pipe.
 - 1. Fill bollards with concrete and crown top.
 - 2. Bollards to be 36 inches above grade, and 30 inches below grade, for a total length of 66 inches.

3. Set bollards in 36 inches by 18 inches concrete foundation. Crown top of concrete at grade.
4. All pipe bollards shall receive a heavy duty plastic bollard cover. Bollard covers shall be as designed to fit a 4 inch diameter pipe bollard, and shall have a crowned cap. Color: Gray.

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. Finish metal fabrications after assembly.

2.11 STEEL PRIMERS AND FINISHES

- A. 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 Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."
- B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS. Provide primer with a VOC content of 340 g/L (2.8 lb/gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2007 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Primer prime at 3.0 mils DFT or approved equal by DuPont or Carboline.
 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 HOT-DIP GALVANIZING

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
 1. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 2. Provide thickness of galvanizing specified in referenced standards.
 3. Galvanizing bath shall contain special high grade zinc and other earthly materials.
 4. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.13 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

- A. Hot-Dip Galvanizing: Match finish specified above.
- B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch

straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:

1. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load). 1kg load, 200 m gloss.
2. Adhesion: ASTM D4541, 1050 psi.
3. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
4. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
5. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
6. Pencil Hardness: ASTM D3363, 3B.
7. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
8. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
9. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

2.14 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. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.15 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.

3. PART 3 EXECUTION

3.01 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 steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of isolation coating.

3.02 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in this Section.
- C. Install pipe columns on concrete footings with grouted base plates. Position and grout column base plates as specified in this Section.
 - 1. Grout base plates of columns supporting steel girders after girders are installed and leveled.

3.04 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.05 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 dry film thickness.
- B. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.
 - 1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight, ZIRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
 - 2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
 - 3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY AND FRAMING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Wood blocking, cants, and nailers.
 - 4. Plywood backing panels.

1.02 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preserved-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

2. PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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, as approved by authority having jurisdiction.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19percent for more than 2-inch nominal thickness unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by

a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- 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. Koppers Performance Chemicals (formerly Osmose); MicroPro/LifeWood micronized copper azole.
- B. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- D. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Fire-Retardant Chemicals: Acceptable to authorities having jurisdiction and containing nontoxic ingredients.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood backing panels after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing

agency.

- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

- A. Framing and Non-Load-Bearing Partitions: No. 2 Common grade.
 - 1. Species: Hem-Fir, Southern Pine, or Spruce Pine Fir; northern species, NLGA.
 - 2. Thickness: 2 inches nominal, and greater.

2.05 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. Cants.
 - 4. Furring.
 - 5. Grounds.
- B. Dimension Lumber Items: No. 2 Common grade.
 - 1. Species: Hem-Fir or Spruce Pine Fir; northern species, NLGA.
 - 2. Thickness: Not more than 2 inches nominal.
- C. Concealed Boards: 19 percent maximum moisture content and the following species and grades:
 - 1. Eastern softwoods; No. 2 Common grade; NeLMA.
 - 2. Northern species; No. 2 Common grade; NLGA.

2.06 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 - 1. Basis of Design: TrusJoist Microllam LVL, or approved equal.
 - 2. MOE = 2.0E.
 - 3. Fb = 2950 psi.
- B. Wood I-Joists: The wood I-Joist manufacturer shall design I-Joists according to the design criteria, and shall provide signed and sealed shop drawings by an Ohio licensed engineer that shows the joist design criteria, sizes, locations, connections, hangers, web stiffeners, bridging, blocking and rim boards.

2.07 PLYWOOD BACKING PANELS

- 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. Columbia Forest Products; PureBond plywood.
 - 2. RoyOMartin; SmartCore plywood.
- B. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.08 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 for mechanical fasteners as appropriate for the substrate.

2.09 METAL FRAMING ANCHORS

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Polyethylene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated. Do not use neoprene materials.
 - 1. Basis of Design: Dow Chemical; Styrofoam Sill Seal Foam Gasket.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, compound, bonded to a high-density polyethylene film, aluminum foil, or spun bonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. 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 Adhesives: Not permitted on the Project without Architect's prior approval.

3. PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF & PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- I. See Specification Section 092110 Gypsum Board Assemblies for gypsum board, and metal stud and gypsum board assemblies.

3.02 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 enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061600

SHEATHING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Oriented strand board (OSB) sheathing, with integral weather barrier attached to wood framing members at exterior wall assemblies.
 - 2. Oriented strand board (OSB) sheathing, attached to wood framing members at roof assemblies.
 - 3. Cement board sheathing, attached to framing members at eaves and soffits.

1.02 SUBMITTALS

- A. Product Data: For each product specified.
 - 1. Include data from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sheathing product through one source from a single manufacturer.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- C. 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."

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.
- B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sheathing that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, water leakage, delamination, or otherwise deteriorating beyond normal wear.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

- A. Oriented Strand Board (OSB): DOC PS 2-10 made with binder containing no added urea formaldehyde.
 - 1. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
 - 2. Factory mark panels to indicate compliance with applicable standard.
- B. Cement Board: ANSI A 118.9 and ASTM C 1288 or 1325, with standard edges/
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. National Gypsum Company; Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.

2.02 WALL SHEATHING

- A. Oriented Strand Board (OSB) Sheathing: Exposure 1, Structural 1 with integral weather-resistive barrier.
 - 1. Basis of Design: Huber Engineered Woods LLC; ZIP System Wall Sheathing.
 - 2. Span Rating: Not less than 32/16; Rated Sheathing 7/16 Performance Category.
 - 3. Edge Profile: Square edge.
 - 4. Factory laminated integral weather-resistive barrier facer.

2.03 ROOF SHEATHING

- A. Oriented Strand Board (OSB) Sheathing: Exposure 1 sheathing.
 - 1. Thickness: 5/8 inch.
 - 2. Span Rating: Not less than 32/16.
 - 3. Edge Profile: Square edge.

2.03 ACCESSORIES

- A. Air Barrier / Sheathing Tape: Pressure-sensitive, self-adhering, cold-applied tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.
 - 1. Basis-of-Design: Huber Engineered Woods; ZIP System Seam and Flashing Tape.
 - 2. Thickness: 0.012 inch.

2.04 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 with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. For pressure-preservative treated sheathing, provide fasteners of Type 304 stainless steel only.
 - 3. Nails, Brads, and Staples: ASTM F 1667.
 - 4. Power-Driven Fasteners: NES NER-272.
 - 5. Wood Screws: ASME B18.6.1.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 or

ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

3.02 INSTALLATION, GENERAL

- A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- D. Securely attach to substrate by fastening as indicated, complying with the following:
 1. Chapter 23 of the International Building Code.
 2. ICC-ES evaluation report for fastener.
 3. NES NER-272 for power-driven fasteners.
- E. Coordinate wall and roof sheathing installation with air/vapor retarders, flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior envelope assembly.

3.03 INSTALLATION, WALL SHEATHING

- A. Install panels with laminated facer to the exterior. Stagger end joints of adjacent panel runs.
- B. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Apply air barrier sheathing tape at joints between and at edges of sheathing boards, at penetrations, and facer defects or cracks to form continuous weathertight surface. Utilize tape gun or hard rubber roller provided by manufacturer to ensure tape is completely adhered to substrates.
 1. Backwrap edges of sheathing board at base of wall.

3.03 INSTALLATION, ROOF SHEATHING

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges

- of wall sheathing panels.
- b. Space panels 1/8 inch apart at edges and ends.

3.04 INSTALLATION, CEMENT BOARD SHEATHING

- A. General: Install cement board sheathing to comply with manufacturer's written instructions.
- B. Apply fasteners so screw heads set flush with face of sheathing board.

END OF SECTION

SECTION 061753

METAL-PLATE-CONNECTED WOOD TRUSSES

1. PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes wood roof trusses and truss accessories.

1.02 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/360 of span.
 - b. Roof Trusses: Horizontal deflection at reactions of 1-1/4 inches (32 mm).

1.04 SUBMITTALS

- A. Product Data: For metal-plate connectors, metal framing anchors, bolts, and fasteners.
- B. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.
 - 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. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- D. Qualification Data: For metal-plate manufacturer professional engineer fabricator and Installer.
- E. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

1.05 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TN quality-control procedures for manufacture of connector plates published in TP1 1.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SP1B, Timber Products Inspection, TP1, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 2. TP1 DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with TP1 recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.07 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

2. PART 2 PRODUCTS

2.01 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. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. CompuTrus, Inc.
 - c. Eagle Metal Products.
 - d. Jager Industries, Inc.
 - e. Mitek Industries, Inc.
 - f. Robbins Engineering, Inc.
 - g. TEE-LOK Corporation.
 - h. Truswal Systems Corporation.
 2. Metal Framing Anchors:
 - a. Alpine Engineered Products, Inc.
 - b. Cleveland Steel Specialty Co.
 - c. Silver Metal Products, Inc.
 - d. Simpson Strong-Tie Company, Inc.
 - e. Southeastern Metals Manufacturing Co., Inc.
 - f. United Steel Products Company, Inc.

2.02 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive natural or stained finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
 - 5. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.03 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TP1 1 from metal complying with requirements indicated below:
- B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180) coating designation; Designation SS, Grade 33, and not less than 0.036 inch (0.9 mm) thick.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).
- F. 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.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn
 - 2. 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).

2.05 METAL FRAMING ANCHORS

- A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
 - 1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
- C. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs and double plates below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to side of truss, face of top plates, and side of stud below.
- D. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, face of top plates, and side of stud below.
- E. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

2.06 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer.

2.07 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TN
 - 1. Position members to produce design camber indicated.
 - 2. Fabricate wood trusses within manufacturing tolerances in TPT I.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

3. PART 3 EXECUTION

3.01 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.

- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses 24 inches (610 mm) o.c. as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
 - 2. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 3. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.

3.02 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION

SECTION 064020

INTERIOR ARCHITECTURAL WOODWORK

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior trim as noted.
 - 2. Plastic-laminate casework.
 - 3. Plastic-laminate countertops and window stools.
 - 4. Solid-surfacing-material for countertops.
 - 5. Closet and utility shelving.

1.02 SUBMITTALS

- A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - a. Provide schedule of blocking required to support the Work of this Section.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
 - 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Verification:
 - 1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
 - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 - a. Submit step-type range sample sets of factory finished plywood and factory finished solid wood in size illustrating wood grain and specified finish, including edge banding detail and any veneer or solid edge glue joints.
 - b. Submit one leaf for every 1000 gross square foot of veneer required.
 - 3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
 - 4. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
 - 5. Solid-surfacing materials, 6 inches square.
- D. Woodwork Quality Standard Compliance Certificates: Submit registration number for AWI Quality Certification Program.
- E. Qualification Data: For Installer and fabricator.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.
- C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.
- D. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified. Upon notice of award, register the work under this section with the AWI Quality Certification Program.
- E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 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.

1.05 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.
 - 1. The HVAC systems as specified elsewhere may not provide for humidity controls. The expected ranges of relative humidity are expected to be as high as 55% to a low of uncontrolled during the heating system. Comply with AWS Section 2, Care and Storage.
- 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.

1.06 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.

2. PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Veneers and Lumber: Provide AWI Custom Grade materials and workmanship, unless otherwise indicated. For species not listed in the AWS comply with the following:
 1. Provide AWI Lumber Grade 1 and AWI Grade AA Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
 - a. Species: Select White Hard Maple and White Birch, plain sawn/sliced, where indicated.
 2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.
 3. Acceptable Fabricator: Architectural Components Group.
- C. Wood Species for Opaque Finish: Any closed-grain hardwood.
- D. Wood Products: Comply with the following:
 1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with recycled content.
 2. Hardboard: AHA A135.4.
 3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
 4. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 5. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
 6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
 - a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 1. Basis of Design:
 - a. PL-1: **Formica 1150-43 Vosges Pear, Artisan Finish.**
 - b. PL-2: **Wilsonart 4842-60 Canyon Zephyr.**
 - c. PL-3: **Nevamar 3008-T Navy Matrix II.**
- F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with

ANSI SS-1 and ISSFA-2.

1. Basis of Design: **Corian Silver Birch.**

2.02 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
 1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 3. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with cross bands to prevent any ammonia fuming from the core to the face veneers.

2.03 CASEWORK HARDWARE AND ACCESSORIES

- A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 087100 - DOOR HARDWARE.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing and concealed.
 1. Basis of Design: Blum; Clip Top series.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
 1. Basis of Design: Hafele 59295, solid arch handle, nominal 3¾ inches centers, brushed nickel finish.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:
 1. Box Drawer Slides: Grade 1.

2. File Drawer Slides: Grade 1HD-100.
 3. Pencil Drawer Slides: Grade 2.
 4. Keyboard Slides: Grade 1.
 5. Trash Bin Slides: Grade 1HD-100.
- G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
 2. Satin Aluminum, Clear Anodized: BHMA 628.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.04 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide 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.
- C. Handrail Brackets: Cast from malleable iron with wall flange drilled [for exposed anchor and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.
- 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 Adhesives: Not permitted on the Project without Architect's prior approval.
- F. Stone Sealer: As recommended by manufacturer for use at stone countertops and splashes.

2.05 FABRICATION, GENERAL

- A. 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.
- B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius

indicated for the following:

1. Corners of Casework and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- 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.
- 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.
- F. Install glass to comply with applicable requirements in Section 088000 - GLAZING and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.06 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.
- C. Back out or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.07 PLASTIC-LAMINATE CASEWORK

- A. Grade: Custom.
- B. AWI Type of Casework Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
 4. Edges: Grade HGS.
- D. Materials for Semiexposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, 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.
 - c. Cabinet Interiors: White melamine cladding.
 2. Drawer Construction: Metal drawer boxes.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range.

2.08 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As selected by Architect from manufacturer's full range.
- D. Edge Treatment: As indicated.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.09 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Custom.
- B. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2.09 CLOSET AND UTILITY SHELIVING

- A. Grade: Custom.
- B. Shelf Material:
 1. Plastic Laminate Shelves: Provide 3/4 in. particleboard with horizontal grade plastic laminate veneer and matching edge bands on all six sides.
- C. Cleats: 3/4-inch solid lumber.
- D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.
- E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.
- F. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.
 1. Rod Flanges: Chrome-plated steel.

2.14 SHOP FINISHING

- A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.
 1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain

surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

- C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.

3. PART 3 EXECUTION

3.01 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.

3.02 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.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. 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.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Fill gaps, if any, between top of wood trim and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. Casework: 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 casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of casework with transparent finish.
- I. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.
1. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
 4. Calk space between backsplash and wall with sealant specified in Section 079200 JOINT SEALANTS.
 5. Apply stone sealer to stone countertops and splashes.
- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 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

SECTION 066400

FRP PANELING

1. PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Construction Drawings, Instructions to Bidders, General Conditions, Special Conditions and Division 1 - General Requirements apply to this section.

1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Low-Emitting Materials:
 - a. For adhesives and sealants, submit test results, including TVOC emissions and VOC content.
- B. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crane Composites.
 - 2. Marlite.
 - 3. Nudo Products, Inc.

2.02 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic (FRP) panels complying with ASTM D 5319.
 - 1. Nominal Thickness: Not less than 0.075 inch.
 - 2. Surface Finish: Molded pebble texture.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.03 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer for substrate indicated.
 - 1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. VOC Content: 50 g/L or less.
 - 3. Do not use adhesives that contain urea formaldehyde.
 - 4. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 - JOINT SEALANTS.
 - 1. Low-Emitting Materials: Provide adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. VOC Content, Architectural Sealants: 250 g/L or less.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to sealants.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even

- surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
 - D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
 - E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.03 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 072100
THERMAL INSULATION

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rigid insulation, at perimeter foundation walls and under slabs-on-grade.
 - 2. Rigid insulation, at perimeter masonry walls and wood stud wall assemblies as indicated.
 - 3. Glass-fiber batt insulation, at exterior envelope.
 - 4. Sprayed polyurethane foam insulation, at gaps and voids.
 - 5. Other building insulation work as may be called for on Drawings and not indicated or specified to be included under other Sections.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For Installer of spray-applied products and Testing Agency.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Testing Agency Qualifications: An independent agency qualified as a "Certified Infrared Thermographer" per ASNT SNT-TC-1A guidelines, Level I certification minimum.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic and spray polyurethane foam 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 materials to Project site before installation time.
 - 3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

2. PART 2 PRODUCTS

2.01 INSULATION AT PERIMETER FOUNDATION WALLS AND UNDER SLABS-ON-GRADE

- 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. DiversiFoam Products.
 - 2. Dow Chemical Company.
 - 3. Owens Corning.
- B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged of type, density, and compressive strength indicated below:
 - 1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
 - 2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
 - 3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100psi minimum compressive strength.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.02 INSULATION AT PERIMETER MASONRY WALLS AND WOOD STUD WALL ASSEMBLIES

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, 1.60 cu.ft. density, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, thickness as indicated on Drawings:
 - 1. Available Product: Styrofoam Brand by Dow Chemical or equal.
 - 2. Compressive Strength, ASTM D 1621: 25 pounds per square inch, minimum.
 - 3. Minimum Thicknesses: As indicated on Drawings.
 - 4. Board Edge: To be selected by Architect.
- B. Air Barrier Tape: CCW-705 Air Barrier Tape by Carlisle Coatings and Waterproofing or equal.
- C. Adhesive for Bonding Insulation at Vertical Surfaces: Product recommended by insulation manufacturer with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.

2.03 GLASS FIBER BLANKET INSULATION

- A. Acceptable Blanket Insulation Manufacturers: Provide products of one of the following manufacturers if they meet or exceed the requirements of these specifications:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Owens-Corning.
- B. Provide resilient, flexible blankets of inorganic, non-asbestos fibers and binders complying with ASTM C665 and having the following properties and characteristics:
 - 1. Thickness:
 - a. 5 1/2" nominal, unfaced, at perimeter walls as noted; to achieve minimum R-21.
 - b. 8 1/4" nominal, FSK faced, at 2 x 10 roof joists as noted; to achieve minimum R-30.
 - c. 10 1/4" nominal, FSK faced, at 11 7/8" roof joists as noted; to achieve minimum R-38.
 - d. 12" nominal, FSK faced, at trusses as noted; to achieve minimum R-38.
 - e. 3 1/2" nominal, unfaced, sound attenuation batts at interior walls as noted.
 - f. 6" nominal, unfaced, sound attenuation batts above office ceilings as noted.
 - 2. Size: Coordinate widths with spaces to be insulated for friction fit.
 - 3. All blanket insulation in roof framing to be FSK faced, and carry a fire hazard classification to meet the requirements of ASTM E84. Include approved strapping for support as necessary and as required.

2.04 SPRAY POLYURETHANE FOAM INSULATION, AT GAPS AND VOIDS

- 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. Dow Chemical; GreatStuff Pro.
 - 2. ICP Adhesives and Sealants (formerly Fomo Products); Handi-Foam products.
- B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.
 - 1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 4.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 2. Fire Resistance: UL 723, Flame Spread 25 max., and Smoke Developed 50 max.
 - 3. VOC Emissions: GreenGuard Gold certification.

2.05 INSULATION ACCESSORIES

- A. Eave Baffles (Ventilation Troughs): Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation from vented eaves to vented roof hips and ridges. Size to fit roof rafters.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ADO Products; Durovent.
 - b. Brentwood Industries; AccuVent.
 - c. Owens Corning; Raft-R-Mate.

3. PART 3 EXECUTION

3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

3.03 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. Spray Polyurethane Foam: Comply with recommendations of the American Chemistry Council, "Health and Safety Product Stewardship Workbook for High-Pressure Application of Spray Polyurethane Foam (SPF)."
 - 1. Spray Polyurethane Foam: Spray insulation no greater than 1-1/2 inch thickness per layer. Allow each layer to fully cure before spraying additional thickness.

2. Contain and fully ventilate the area being sprayed with negative air machines, venting directly to the exterior. Do not operate permanent building HVAC system during installation. Continue ventilation during curing process.
 3. Install spray polyurethane foam insulation with uniform full thickness and with density which will not displace adjacent materials.
 4. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- E. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.
1. Cure insulation with continuous natural or mechanical ventilation.
 2. Remove and dispose of over-spray.

3.04 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade.
- B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.05 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.

3.06 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Glass-Fiber Blanket Insulation: Install 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 the cavities, 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 clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.
- B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.
1. Provide complete digital report with recommendations for repairs.
- C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.

- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.08 PROTECTION

- A. Protect installed insulation 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.

END OF SECTION

SECTION 072410

EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

1. PART 1 GENERAL

1.01 SUMMARY

- A. Provide water-draining, polymer-based exterior insulation and finish system (EIFS) including but not limited to the following components:
 - 1. Flexible flashing.
 - 2. Adhesive; vertically channeled to permit water drainage.
 - 3. Rigid insulation.
 - 4. Reinforcing mesh.
 - 5. Finish coat.

1.02 COORDINATION

- A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, flashing, trim, joint sealants, windows and doors are protected against damage from the effects of weather, age, corrosion, moisture and other causes. Do not allow water to penetrate behind flashing and barrier coating of EIFS.

1.03 SYSTEM DESCRIPTION

- A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
- B. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

1.04 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with the following:
 - 1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - 2. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
- B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
 - 1. Abrasion Resistance: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.
 - 2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per ASTM E 2485.
 - 3. Accelerated Weathering: Five samples per ASTM E 2568 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that

- might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153, ASTM G 154 or ASTM G 155.
4. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
 5. Salt-Spray Resistance: No deleterious affects when tested according to ASTM E 2568.
 6. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ASTM E 2134.
 7. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per International Building Code.
 8. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
 9. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per ASTM E 2486; and meeting or exceeding the following:
 - a. Standard Impact Resistance: 25 to 49 inch-lb.
 - b. Medium Impact Resistance: 50 to 89 inch-lb.
 - c. High Impact Resistance: 90 to 150 inch-lb.
 - d. Ultra-High Impact Resistance: More than 150 inch-lb.
 10. Structural Performance Testing: EIFS assembly and components shall be tested per ASTM E 330.

1.05 SUBMITTALS

- A. Product Data: For each type and component of EIFS indicated.
- B. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
 1. Include similar Samples of joint sealants and exposed accessories involving color selection.
- D. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, an aesthetic reveal, a typical control joint filled with sealant of color selected.
 1. Include sealants and exposed accessory Samples to verify color selected.
- E. Qualification Data: For Installer and testing agency.
- F. Manufacturer Certificates: Signed by manufacturers certifying that EIFS comply with requirements.
- G. Material or Product Certificates: For each insulation and joint sealant, from manufacturer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each insulation, reinforcing mesh, and coating.
- I. Field quality-control reports.

- J. Maintenance Data: For EIFS to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers. Installer shall possess a current manufacturer's certificate of education and be experienced and competent in installation of plaster-like materials.
1. Fabricator/Erector Qualifications: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.
- C. Regulatory Requirements: Insulation Board must be produced and labeled under a third party quality program as required by applicable building codes.
- D. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by IBC. Identify products with appropriate markings of applicable code.
1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which EIFS is a part, complies with NFPA 285 for test method Green, OH September 23, 2019 and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies containing foam-plastic insulation.
 3. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
 4. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials in a cool location, inside and under cover and at a temperature above 40°F (4°C) and below 110°F (43°C); keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes, and in accordance with manufacturer's instructions.
1. Stack insulation board flat and off the ground.
 2. Protect plastic insulation 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.

1.09 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

- A. Provide manufacturer's standard warranty.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dryvit Systems Inc.
 - 2. Parex USA, Inc.
 - 3. Senergy, BASF Wall Systems
 - 4. Sto Corp.
 - 5. Greenmaker Industries.
- B. Basis of Design: Sto Corp; StoTherm ci Essence E100G NExT.

2.02 MATERIALS

- A. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
- B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC209.
 - 1. Sheathing Joint Compound and Tape: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.
- C. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
- D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- E. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate.
- F. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:

1. Thickness: As indicated on Drawings.
 2. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
 3. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
 4. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated, but not more than allowed in the EIFS manufacturer's current ICC Evaluation Service Report.
 5. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.
- G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:
1. Standard-Impact Reinforcing Mesh: Not less than 4.5 oz./sq. yd.
- H. Base-Coat Materials: EIFS manufacturer's standard mixture complying with the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
- I. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation and complying with the following:
1. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 2. Project Locations: Provide for base coat over foundations, parapets, splash areas trim and other projecting features.
- J. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- K. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance, complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. **Texture: Limestone.**
 3. Color: As selected by Architect from manufacturer's standard colors.
- L. Water: Potable.
- M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.
1. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
 2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
 3. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
 4. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

2.03 ELASTOMERIC SEALANTS

- A. Refer to Section 079200 - JOINT SEALANTS for sealing joints in EIFS with elastomeric joint sealants.

2.04 MIXING

- A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.03 EIFS INSTALLATION, GENERAL

- A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.04 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over gypsum sheathing CMU, or concrete substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- B. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier and air barrier.
 - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime

substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.05 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
 - 1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
 - 2. Windowsill Flashing: Use at windows unless otherwise indicated.
 - 3. Expansion Joint: Use where indicated on Drawings.
 - 4. Parapet Cap Flashing: Where indicated on Drawings.
 - 5. Other Trim: Use where indicated on Drawings.

3.06 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
 - 1. Apply adhesive to in vertical "channels" in accordance with EIFS manufacturer's written instructions to permit drainage to base flashing. Apply adhesive channels in thickness as recommended by the manufacturer for application.
 - 2. Press and slide insulation into place to provide uniform contact with all adhesive channels while maintaining space between channels to permit drainage.
 - 3. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
 - 4. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
 - 5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 - 6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.
 - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
 - 7. Interlock ends at internal and external corners.
 - 8. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 - 9. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 - 10. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
 - 11. Interrupt insulation for expansion joints where indicated.
 - 12. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.

13. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
 14. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 15. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
 2. Where EIFS adjoins dissimilar substrates, materials, and construction, including other EIFS.
 3. At floor lines in multilevel wood-framed construction.
 4. Where wall height or building shape changes.
 5. Where EIFS manufacturer requires joints in long continuous elevations.

3.07 BASE-COAT INSTALLATION

- A. Waterproof Adhesive/Base Coat: Apply over sloped surfaces, window sills, parapets, and where indicated on Drawings to protect substrates from degradation.
- B. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- C. Reinforcing Mesh: Embed type indicated in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
- D. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of intermediate-impact reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- E. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
 2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- E. Foam Shapes: Fully embed reinforcing mesh in base coat.
- G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.

3.08 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
- B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Texture: As indicated by manufacturer's designations on approved Shop Drawings.

3.09 INSTALLATION OF JOINT SEALANTS

- A. Refer to Section 079200 - JOINT SEALANTS for sealing joints in EIFS with elastomeric joint sealants.

3.10 FIELD QUALITY CONTROL

- A. EIFS Tests and Inspections: According to ASTM E 2273 "Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies."
- B. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.
- C. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

SECTION 072450

DIRECT APPLIED FINISH SYSTEM (DAFS)

1. PART 1 GENERAL

1.01 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Direct-applied finish system (DAFS) applied over exterior cementitious sheathing, at building canopies and elsewhere as indicated.

1.02 PERFORMANCE REQUIREMENTS

- A. DAFS Performance: Comply with the following:
 - 1. Bond Integrity: Free from bond failure within DAFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - 2. Weathertightness: Resistant to water penetration from exterior into DAFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of DAFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
- B. Class PB DAFS: Provide DAFS having physical properties and structural performance that comply with the following:
 - 1. Abrasion Resistance: Sample consisting of 1-inch- thick DAFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.
 - 2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
 - 3. Accelerated Weathering: Five samples per ICC-ES AC219 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154.
 - 4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01.
 - 5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
 - 6. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC219.
 - 7. Tensile Adhesion: No failure in the DAFS, adhesive, base coat, or finish coat when tested per EIMA 101.03.
 - 8. Water Penetration: Sample consisting of 1-inch- thick DAFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
 - 9. Water Resistance: Three samples, each consisting of 1-inch- thick DAFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.

10. Wind-Driven-Rain Resistance: Resist wind-driven rain according to ICC-ES AC219.
11. Impact Resistance: Sample consisting of 1-inch- thick DAFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
 - a. Standard Impact Resistance: 25 to 49 inch-lb.
12. Structural Performance Testing: DAFS assembly and components shall comply with ICC-ES AC219 when tested per ASTM E 330.

1.03 SUBMITTALS

- A. Product Data: For each type and component of DAFS indicated.
- B. Shop Drawings: For DAFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
 1. Include similar Samples of exposed accessories involving color selection.
- D. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including a typical control joint filled with sealant of color selected.
 1. Include sealants and exposed accessory Samples to verify color selected.
- E. Qualification Data: For Installer, fabricator/erector, and testing agency.
- F. Material or Product Certificates: For cementitious materials and joint sealant, from manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for reinforcing mesh, and coating.
- H. Field quality-control reports.
- I. Maintenance Data: For DAFS to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by DAFS manufacturer as qualified to install manufacturer's system using trained workers.
- B. Source Limitations: Obtain DAFS from single source from single DAFS manufacturer and from sources approved by DAFS manufacturer as compatible with system components.
- C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 1. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.06 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply DAFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit DAFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.07 COORDINATION

- A. Coordinate installation of DAFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of DAFS.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dryvit Systems, Inc.
 - 2. Parex, Inc.; a brand of Parex Lahabra, Inc.
 - 3. Pleko LLC.
 - 4. Senergy; Degussa Wall Systems, Inc.
 - 5. SonoWall; Degussa Wall Systems, Inc.
 - 6. Sto Corp.

2.02 MATERIALS

- A. Compatibility: Provide adhesive, fasteners, sheathing, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by DAFS manufacturer for Project.
- B. Water-Resistive Coatings: DAFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC212.
- C. Primer/Sealer: DAFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated.
- D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; DAFS manufacturer's standard or product recommended in writing by DAFS manufacturer.
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other DAFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098 or EIMA 105.01; complying with ASTM D 578 and the following:
 - 1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 - 2. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 - 3. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.

- F. Base-Coat Materials: DAFS manufacturer's standard mixture complying with one of the following:
 - 1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - 4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- G. Waterproof Adhesive/Base-Coat Materials: DAFS manufacturer's standard waterproof formulation complying with one of the following:
 - 1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
- H. Primer: DAFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- I. Finish-Coat Materials: DAFS manufacturer's standard acrylic-based coating with enhanced mildew resistance, complying with the following:
 - 1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
- J. Water: Potable.
- K. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with DAFS manufacturer's written instructions; manufactured from zinc.
 - 1. Casing Bead: Prefabricated, one-piece type, of depth required to suit thickness of coating, with face leg perforated for bonding to coating and back leg.
 - 2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

2.03 MIXING

- A. General: Comply with DAFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by DAFS manufacturer. Mix materials in clean containers. Use materials within time period specified by DAFS manufacturer or discard.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of DAFS.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where DAFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of DAFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect DAFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind DAFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with DAFS manufacturer's written instructions to obtain optimum bond between substrate and coating.

3.03 DAFS INSTALLATION, GENERAL

- A. Comply with ASTM C 1397 and DAFS manufacturer's written instructions for installation of DAFS as applicable to each type of substrate indicated.

3.04 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by DAFS manufacturer for improving adhesion of coating to substrate.
- B. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by DAFS manufacturer's written instructions.
- B. Waterproof Adhesive/Base Coat: Apply over sloped surfaces and where indicated on Drawings to protect substrates from degradation.
- D. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by DAFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with DAFS manufacturer's written instructions and details.

3.05 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of DAFS, at expansion joints, at vent sills, and elsewhere as indicated, according to DAFS manufacturer's written instructions.
 1. Expansion Joint: Use where indicated on Drawings.
 2. Casing Bead: Use at other locations.

3.06 BASE-COAT INSTALLATION

- A. Base Coat: Apply to exposed surfaces of sheathing in minimum thickness recommended in writing by DAFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and DAFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

- C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
 - 1. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.07 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to DAFS manufacturer's written instructions.
- B. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by DAFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. **Texture: Limestone.**
 - 2. Color: As selected by Architect from manufacturer's standard colors.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests and inspections and to prepare test reports.
- B. DAFS Tests and Inspections: Comply with testing requirements of authorities having jurisdiction.
 - 1. Notify Contracting Officer and Owner 48 hours in advance of date and time of inspection.
- B. Remove and replace DAFS where test results indicate that DAFS do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from vent, window and door frames and other surfaces outside areas indicated to receive DAFS coatings.

END OF SECTION

SECTION 076113

STANDING SEAM SHEET METAL ROOFING

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preformed, prefinished metal roofing and flashings.
- B. Miscellaneous trim, flashing, closures, drips, venting and accessories.
- C. Underlayment.
- D. Sealant.
- E. Fastening devices.

1.02 REFERENCES

- A. American Iron & Steel Institute (AISI) Specification for the Design of Coldformed Steel Structural Members.
- B. ASTM A-653 & ASTM A924 Steel Sheet, Zinc-Coated (Galvanized)
- C. ASTM E-283-84
- D. ASTM E-331-86
- E. ASTM E-1592
- F. Spec Data Sheet - Galvalume Sheet Metal by Bethlehem Corp.
- G. SMACNA - Architectural Sheet Metal Manual.
- H. Building Materials Directory - Underwriter's Laboratories, Test Procedure 580.

1.03 ASSEMBLY DESCRIPTION

- A. The roofing assembly includes preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.

1.05 SUBMITTALS

- A. Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work.
- B. Submit a sample of each type of roof panel, complete with factory finish.
- C. Submit results indicating compliance with minimum requirements of the following performance tests:
 - 1. Air Infiltration ASTM E 283-84

- 2. Water Infiltration ASTM E 331-86
- 3. Wind Uplift - U.L.90

- D. Submit calculations with registered engineer seal, verifying roof panel and attachment method resists wind pressures imposed on it pursuant to applicable building codes.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.
- B. No product substitutions shall be permitted without meeting specifications.
- E. Substitutions shall be submitted 10 Days prior to Bid Date and acceptance put forth in an addendum.
- D. No substitutions shall be made after the Bid Date.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.
- B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.
- C. Panels with strippable film must not be stored in the open, exposed to the sun.
- D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.08 WARRANTY

- A. Paint finish shall have a twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).
- B. Galvalume material shall have a twenty year guarantee against failure due to corrosion, rupture or perforation.
- C. Applicator shall furnish guarantee covering watertightness of the roofing system for the period of two (2) years from the date of substantial completion.

2. PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Berridge Manufacturing Company, Houston, Texas.
1720 Maury Street
Houston, Texas 77026
Phone: (800) 231-8127
Fax: (713) 236-9422
- B. Equivalent system by Dimensional Metals, Inc. may be listed as a voluntary substitution on the Substitution Sheet included in the Specifications.

2.02 SHEET MATERIALS

- A. Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Galvalume®) Steel Sheet, 24-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min.
- B. Finish shall be full strength Kynar 500® or Hylar 5000™ fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil. Bottom side shall be coated with a primer and beige urethane coating with a total dry film thickness of 0.35 ± 0.05 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500® or Hylar 5000™ finish supplier.
- C. Color shall be **Royal Blue**.
- F. Strippable film shall be applied to the top side of all prefinished metal to protect the finish during fabrication, shipping and field handling. This strippable film MUST be removed immediately before installation.
- G. Unpainted metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Acrylic Coated Galvalume®) Steel Sheet, 24-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min., with clear acrylic coating on both sides of material.
- F. Field protection must be provided by the contractor at the job site so stacked or coiled material is not exposed to weather and moisture.
- G. Flashing maybe factory fabricated or field fabricated. Unless otherwise specified all exposed adjacent flashing shall be of the same material and finish as panel system.

2.03 ACCESSORY MATERIALS

- A. Snow Guards: S-5!, ColorGard System with color strip to match roof.
- B. Fasteners: Stainless Steel with washers where required.
- C. Sealant: As specified in Section 07900.
- D. Vinyl Weatherseal Insert.

2.04 FABRICATION

- A. All exposed adjacent flashing shall be of the same material and finish as the roof panels.
- B. Hem all exposed edges of flashing on underside, 1/2 inch.

2.05 STANDING SEAM TEE-PANEL

- A. Panels shall have 12 3/4" on-center seam spacing with a seam height of 1".
- B. Panels shall be site-formed with the Berridge Model SS-14 Portable Roll Former in continuous lengths from eave to ridge or factory fabricated to 40' max.
- C. Snap-on seams shall be 1" in height and shall contain the Berridge factory-applied Extruded Vinyl Weather Seal Insert (Patent No. 4641475) to prevent siphoning of moisture through the standing seam.
- D. Concealed anchor clips shall be spaced as required to meet uplift loads (maximum of 24" on center).

- E. When required, Panel assembly shall bear Underwriters Laboratories Label UL90, pursuant to Construction Number 296 and applicable Fire Ratings.
- F. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage beyond allowable tolerances through the system when tested in accordance with ASTM E-331-86 and E-283-84.

3. PART 3 EXECUTION

3.01 INSPECTION

- A. Substrate:
 - 1. Examine plywood or metal deck to ensure proper attachment to framing.
 - 2. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to $\pm 1/4"$ in 20', and properly sloped to valleys and eaves.
 - 3. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
 - 4. Verify deck is dry and free of snow or ice. Joints in wood deck to be solidly supported and nailed.
- B. Felting:
 - 1. Verify #30 unperforated asphalt saturated roofing felt underlayment has been installed over solid sheathing and fastened in place.
 - 2. Ensure felt installed horizontally, starting at eave to ridge with a 6" minimum overlap and 18" endlaps.
 - 3. Ensure that all nail heads are totally flush with the substrate. Nails shall be galvanized roofing nails with Berridge Coated Felt Caps.

3.02 INSTALLATION

- A. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.
- B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.
- C. Install starter and edge trim before installing roof panels.
- D. Remove protective strippable film prior to installation of roof panels.
- E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.
- F. Install sealants for preformed roofing panels as approved on shop drawings.
- G. Do not allow panels or trim to come into contact with dissimilar materials.
- H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
- I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
- J. Remove and replace any panels or components which are damaged beyond successful repair.

3.03 CLEANING

- A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.
- B. Remove all scrap and construction debris from the site.

3.04 FINAL INSPECTION

- A. Final inspection shall be performed by a firm approved by the roofing manufacturer, and paid for by the roofing installation Contractor.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

1 PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:
 - 1. Roof drainage systems.
 - 2. Exposed trim and fasciae.
 - 3. Metal flashing.
 - 4. Reglets.

1.02 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.
- B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:
 - 1. Wind Zone 1: Wind pressures of 21 to 30 psf (1.00 to 1.44 kPa).

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division I Specification Sections.
- B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details,
- D. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
 - 1. 8-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch- (300-mm-) long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
 - 1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
- C. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 1. Construct mockups for the following type of sheet metal flashing and trim:
 - a. Gutters and downspouts.
 - b. Conductor heads.
 - c. Scuppers.
 - d. Exposed trim, gravel stops, and fascia.
 - e. Copings.
 - 2. Obtain Architect's approval of mockups before start of final unit of Work.
 - 3. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. When directed, demolish and remove mockups from Project site.
 - b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.05 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

2. PART 2 PRODUCTS

2.01 METALS

- A. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch (0.85 mm) thick, unless otherwise indicated.

2.02 REGLETS

- A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with roof and flashing indicated.
- B. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- C. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
- D. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

1. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- F. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Fry Reglet Corporation.
 2. Hickman: W.P. Hickman Co.
 3. Keystone Flashing Company.
 4. Roof/Siding Manufacturer.

2.03 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- E. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- F. Paper Slip Sheet: 5-lb/square (0.244 kg/sq. m) red rosin, sized building paper conforming to FS UU-B790, Type I, Style Ib.
- G. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- (0.15-mm-) thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.04 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and

seal with epoxy seam sealer. Rivet joints for additional strength.

- E. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view except as indicated on the drawings.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.05 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Downspouts: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- C. Conductor Heads: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 =l) thick.
- D. Exposed Trim and Fasciae: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.
- E. Base Flashing: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 =l) thick.
- F. Counterflashing: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- G. Flashing Receivers: Fabricate from the following material:
 - 1. Aluminum: 0.0320 inch (0.8 mm) thick.
 - 2. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- H. Valley Flashing: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.
- I. Drip Edges: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

- J. Eave Flashing: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- K. Roof-Penetration Flashing: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.
- L. Roof-to-Wall Expansion-Joint Cover: Fabricate from the following material:
 - 1. Coil-Coated Galvanized Steel: 0.0336 inch (0.85 mm) thick.
- M. Roof Gutters (see drawings for profile)
 - 1. Coil coated galvanized steel finish painted both sides.

2.06 COIL-COATED GALVANIZED STEEL SHEET FINISH

- A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.
 - 1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
 - a. Color and Gloss: Match Architect's sample.
 - b. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:
 - 1) Ausimont USA, Inc. (Hylar 5000)
 - 2) Elf Atochem North America, Inc. (Kynar 500)
 - 2. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Berridge (specified roofing system manufacturer).
 - b. Centria.
 - c. Robertson.
 - d. Approved Equal.
- B. Shop Finish, Rain Drainage: Provide manufacturer's standard baked-on, acrylic shop finish on sheet metal rain-drainage units (gutters, downspouts, and similar exposed units); 1.0-mil (0.025-mm) dry film thickness.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's

"Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
- D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- E. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints.
- F. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- G. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
 - 2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
- H. Install reglets to receive counterflashing according to the following requirements:
 - 1. Where reglets are shown in concrete, furnish reglets for installation under Division 3 Section "Cast-in-Place Concrete."
 - 2. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."
- I. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.
- J. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for sloped roofs with roofing installation.
- K. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing

and installation of items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.
- L. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.03 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

SECTION 079200

JOINT SEALANTS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Joint sealants and fillers.
- B. This Section includes joint sealants for the applications specified with the products in this Section and as indicated on Drawings.

1.02 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.

1.03 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Qualification Data: For Installer.
- D. 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.
- E. 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.
- F. Field Test Report Log: For each elastomeric sealant application.
- G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.04 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. 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 method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with joint sealant backing and glazing and gasket materials.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 4. Report whether sealant in joint 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. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.05 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
 - 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.

1.06 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 Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. 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.

2. PART 2 PRODUCTS

2.01 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. Architectural 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: Provide colors as selected by the Architect from manufacturer's full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.02 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: Elastomeric sealants shall 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. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral-Curing Silicone Sealant:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco Inc.; Spectrem 1.

- d. Pecora Corporation; 864.
 - e. Bondaflex Technologies; Sil 290.
 - 2. Extent of Use: Joints in exterior vertical and soffit surfaces.
- E. Multicomponent Pourable Urethane Sealant:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik Findley; Chem-Calk 550.
 - b. Meadows, W. R., Inc.; POURTHANE.
 - c. Pecora Corporation; Urexpan NR-200.
 - d. Tremco Inc.; THC-901.
 - e. Bondaflex Technologies; PUR 2 SL.
 - 2. Extent of Use: Joints in exterior horizontal surfaces.
- F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Silicones; Sanitary SCS1700.
 - c. Tremco Inc.; Tremsil 200.
 - d. Bondaflex Technologies; Sil 100 WF.
 - e. Pecora 898NST.
 - 2. Extent of Use: Sanitary joints at toilet rooms.
- G. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik Findley; Chem-Calk 600.
 - b. Pecora Corporation; AC-20+.
 - c. Sonneborn, BASF Building Systems; Sonolac.
 - d. Tremco Inc.; Tremflex 834.
 - e. May National Bondaflex Sil-A 700.
 - 2. Extent of Use: Non-moving joints at interior locations.
- H. Solvent-Release-Curing Acrylic-Based Joint Sealant: ASTM C 1311.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Schnee-Morehead, Inc.; Acryl-R Acrylic Sealant.
 - b. Tremco Incorporated; Mono 555.
 - 2. Extent of Use: Joints at PVC trim and panels.

2.03 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or other type, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 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.

3. PART 3 EXECUTION

3.01 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.

3.02 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 concrete, masonry and 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 metal, glass, porcelain enamel and 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.

3.03 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.

3.04 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.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081110

HOLLOW METAL DOORS AND FRAMES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Standard hollow-metal steel doors.
 - 2. Standard hollow-metal steel frames.

1.02 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. Shop Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- D. Qualification Data: For Installer.
- E. 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.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- 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-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

- D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): Complying with NFPA 80 and 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 257 or UL 9.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 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.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.06 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

2. PART 2 PRODUCTS

2.01 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. Ceco Door Products; an ASSA ABLOY Group Company.
 - 2. CURRIES Company; an ASSA ABLOY Group Company.
 - 3. de LaFontaine
 - 4. Mesker Door Inc.
 - 5. Pioneer Industries, Inc.
 - 6. Philipp Manufacturing Company.
 - 7. Republic Builders Products Company.
 - 8. Steelcraft; an Allegion company.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 - GLAZING.
- J. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, VOC compliant, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 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) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
 - 4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1 3/4 inches thick.
- C. 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 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with full profile welded joints.
 2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
1. Fabricate frames with full profile welded joints.
 2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.06 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.07 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.08 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.09 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 - 2. Full Profile Welded Frames at Fire-Rated Doors and Exterior Doors: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 - 3. Interlocking (Knock-Down) Frames at 20-Minute-Rated Doors and Non-Rated Doors: Interlocking with visible seams.
 - 4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.

5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 6. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 8. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 9. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with electrical drawings and specifications.
- G. 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 hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings, so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - 2. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.

- b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply isolation coating to backs of frames that are filled with grout.
 - 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. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame 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. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with hollow metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081210

INTERIOR ALUMINUM FRAMES – TYPE 2

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Interior aluminum frames for doors and glazing installed in gypsum board partitions.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 2. Locations of reinforcements and preparations for hardware.
 3. Details of each different wall-opening condition.
 4. Details of anchorages, joints, field splices, and connections.
 5. Details of accessories.
 6. Details of moldings, removable stops, and glazing.
 7. Details of conduits and preparations for power, signal, and control systems.
- C. Samples for Verification: For interior aluminum frames, prepared on Samples of size indicated below:
1. Framing Member: 12 inches long.
 2. Corner Fabrication: 12-by-12-inch-long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.
- D. Schedule: For interior aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of interior aluminum frame.
- F. Maintenance Data: For interior aluminum frames to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain interior aluminum frames from single source from single manufacturer.
- B. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver interior aluminum frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store interior aluminum frames under cover at Project site.

1.05 WARRANTY

- A. Warrant against defects in manufacturing of materials for a period of one year from date of substantial completion.
- B. Warrant framing finish against defects, including cracking, flaking, blistering, peeling, and excessive fading, chalking and non-uniformity in color for a period of five years.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS – FRAME TYPE 2

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Frameworks Manufacturing.
 - 2. RACO Interior Products, Inc.
 - 3. Spaceworks Aluminum Frames.
 - 4. Western Integrated Materials, Inc.
 - 5. Wilson Partitions, a division of Arcadia Inc.
- B. Basis of Design: RACO Solutions II, 500 Series.

2.02 COMPONENTS

- A. Aluminum Framing: ASTM B 221, Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
 - 1. 90-Minute Fire-Protection Rating: Fabricate aluminum frame assemblies with a cold-formed, primed, interior steel liner where indicated.
- C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.
- D. Ceiling Tracks: Extruded aluminum.
- E. Trim: Extruded aluminum, not less than 0.062 inch thick, with removable snap-in casing trim glazing stops and door stops without exposed fasteners.

2.03 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.
- C. Smoke Seals: Intumescent strip or fire-rated gaskets.
- D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated.

- E. Glazing: Comply with requirements in Section 088000 – GLAZING.
- F. Hardware: Comply with requirements in Section 087100 - DOOR HARDWARE.

2.04 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.
- B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
 - 1. Locate hardware as required by fire-rated label for assembly.
- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

2.04 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Architectural Class II, 0.40 mils or thicker.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Set frames accurately in position and plumbed, aligned, and securely anchored to substrates.
 - 1. At fire-protection-rated openings, install interior aluminum frames according to NFPA 80 and NFPA 105.
- C. Install frame components in the longest possible lengths; components up to 96 inches long must be one piece.
 - 1. Fasten to suspended ceiling grid on maximum 48-inch centers, using sheet metal screws

or other fasteners approved by frame manufacturer.

2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 3. Secure clips to extruded main-frame components and not to snap-in or trim members.
 4. Do not leave screws or other fasteners exposed to view when installation is complete.
- D. Install glazing as specified in Section 088000 - GLAZING.

3.03 CLEANING

- A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.
- B. Touch up marred frame surfaces so touchup is not visible from a distance of 48 inches. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION

SECTION 081400
FLUSH WOOD DOORS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing for wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 - 4. Louvers and glass lites for flush wood doors.

1.02 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, 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 specifications.
 - 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 for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of finish color, sheen, and grain to be expected in the finished work.
 - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. 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 at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250deg C) above ambient after 30 minutes of standard fire-test exposure.

- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.05 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.

1.06 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 in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall include hardware installation and replacement of glass and glazing.
 - 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

2. PART 2 PRODUCTS

2.01 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. Basis of Design: Masonite Architectural; Aspiro and Graham Series.
 - 2. Lambton Doors; EnviroDesign Series
 - 3. Oregon Doors; Architectural Series.
 - 4. VT Industries Inc.; Eggers and Heritage Collections.

2.02 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:
 - 1. Grade: AWI Premium, with AWI Grade A faces.
 - 2. Species and Cut: As selected by Architect.
 - 3. Match between Veneer Leaves: Slip match.
 - 4. Assembly of Veneer Leaves on Door Faces: Center balanced.
 - 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Transom Match: Continuous match.
7. Stiles: Same species as faces.
8. Cross-Banding: 1/8 in. high density fiberboard, urea formaldehyde free.
9. Adhesives: Type I per WDMA T.M.-6.

2.03 SOLID-CORE DOORS

- A. Cores: Comply with the following requirements:
 1. Particle Core: ANSI A 208.1, Grade 1-LD-2.
 2. Structural Composite Lumber Core: Timberstrand LSL, WDMA I.S.10.
 3. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light or louver cutouts exceed 40% of the door area.
- B. Interior Veneer-Faced Doors:
 1. Construction: Five plies, hot-pressed, 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.
 - a. Fire Retardant Mineral Core, with no added urea formaldehyde cross-banding.
 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.
 - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.
 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. Provide stiles with concealed intumescent seals.

2.04 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood, chevron-style, louvers, unless otherwise indicated. Species to match veneer.
- B. 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.
- C. 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.

2.05 GLAZING SYSTEMS

- A. Glazing: Provide factory installed glass products in accordance with requirements in Section 088000 - GLAZING.

2.06 FABRICATION

- A. 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.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, 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. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
 - 2. Metal Astragals: Factory prime and premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.
- 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.
 - 3. Glass: Factory install glass products in prepared openings.

2.07 FACTORY FINISHING

- A. Finish doors at factory that are indicated to receive transparent finish. Factory prime and prepare for field finish doors indicated to receive opaque finish.
- B. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed solvent-based polyurethane.
 - 3. Staining: Provide custom color as selected by Architect.
 - 4. Sheen: Satin.
 - 5. **Color: BASIS OF DESIGN: Marshfield White Birch Rotary Cut *Bombay 64-02*.**

3. PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Hardware: For installation, see Section 087100 - 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.

- 2. Install smoke and draft control doors according to NFPA 105.
 - C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- 3.03 ADJUSTING
- A. Operation: Rehang or replace doors that do not swing or operate freely.
 - B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.
 - C. 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

SECTION 083110

ACCESS DOORS AND FRAMES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Access doors and frames for walls and ceilings.

1.02 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors and frames.
 - 2. ASTM E 119 for horizontal access doors and frames.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.04 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

2. PART 2 PRODUCTS

2.01 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 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. Steel Sheet: Electrolytic zinc-coated, ASTM A 879/A 879M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPCSP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.02 STAINLESS-STEEL MATERIALS

- A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Finish: Directional Satin Finish, No. 4.

2.03 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Acudor Products, Inc.
 - 2. Babcock-Davis; A Cierra Products Co.
 - 3. Dur-Red Products.
 - 4. J. L. Industries, Inc.
 - 5. Karp Associates, Inc.
 - 6. Larsen's Manufacturing Company.
 - 7. Milcor Inc.
 - 8. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 - 4. Hinges: Continuous piano.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.

4. Hinges: Concealed pivoting rod hinge.
5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.

2.04 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

3. PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 084110

ALUMINUM FRAMED ENTRANCES AND STOREFRONTS – TYPE 1

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Exterior and interior aluminum-framed storefronts.
 2. Exterior and interior manual-swing aluminum doors.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design entrance and storefront system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
1. Structural loads.
 2. Thermal movements.
 3. Dimensional tolerances of building frame and other adjacent construction.
 4. 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. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units to function properly.
- C. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- D. 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 (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.
- E. 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, ambient; 180 deg F, material surfaces.

- F. Air Infiltration Test: Test unit in accordance with ASTM E 283, as follows:
 - 1. Static Air Pressure Difference: 6.24 psf for fixed storefront units, and 1.567 psf for doors.
 - 2. Performance: Maximum air leakage shall not exceed the following: fixed storefront units, 1.0 cfm/sf.; glazed entrance door units, 0.3 cfm/sf.
- G. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.
 - 1. Test Pressure: 8 psf.
 - 2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.
- H. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- I. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.
- J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 for fixed storefront units and not less than 48 for doors when tested according to AAMA 1503.

1.03 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 of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 - 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. Delegated-Design Submittal: For entrance and storefront systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
- G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.

- H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- I. Warranties: Special warranties specified in this Section.

1.04 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 the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of entrance and storefront systems that are similar to those indicated for this Project in material, design, and extent. |
- C. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
- D. Accessible Entrances: Comply with authorities having jurisdiction, local state building code and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.05 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.

1.06 WARRANTY

- A. 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: 10 years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS - FRAME TYPE 1

- 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. Storefront, 2 inch by 4-1/2 inch profile, at interior locations:
 - a. Kawneer North America, VG451.
 - b. Oldcastle Building Envelope, FG-3000.
 - c. Tubelite Inc., E14000.
 - 2. Storefront, Thermal Break, 2 inch by 4-1/2 inch profile, at exterior locations:
 - a. Kawneer North America, VG451T.
 - b. Oldcastle Building Envelope, 3000 Thermal Multiplane.
 - c. Tubelite Inc., T14000.
 - 3. Manual Swing Type Doors, Wide Stile:
 - a. Kawneer North America, 500.

- b. Oldcastle BuildingEnvelope, 500.
- c. Tubelite Inc., Standard Wide Stile Entrance.

2.02 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 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.

2.03 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-break.
- 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.

2.04 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - 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.

2.05 DOORS

- A. Swinging Doors: Manufacturer's standard glazed doors, for manual swing operation.
 - 1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.06 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
 - 1. Opening-Force Requirements:
 - a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf.
- B. Hardware Sets: Provide as specified in Section 087100 - DOOR HARDWARE.

2.07 ACCESSORY MATERIALS

- A. Insulating Materials: As specified in Section 072100 - THERMAL INSULATION.
- B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.
- C. Bituminous Paint (Isolation Coating): Cold-applied asphalt-mastic paint complying with ASTM D 1187 requirements, containing no asbestos, formulated for 30-mil thickness per coat.

2.08 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. 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. 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.

- F. 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.
- G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 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. Color Anodic Finish: AA-M12C22A44, complying with AAMA 611. Clear color.

3. PART 3 EXECUTION

3.01 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.

3.02 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 Section 079200 - 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 Section 088000 - 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 Section 079200 - 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. 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; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.03 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 Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
 - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 4.18 lbf/sq. ft., and shall not evidence water penetration.
 - 3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 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 from the latch measured to the leading door edge.

END OF SECTION

SECTION 087100

DOOR HARDWARE

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. The work in this section includes furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors. Except items which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.

1.02 REFERENCES

- A. Standards:
1. ANSI-A250.4 – Steel Doors and Frames Physical Endurance.
 2. ANSI A156.1 – Butts and Hinges.
 3. ANSI A156.2 – Bored Locks and Latches.
 4. ANSI A156.3 – Exit Devices.
 5. ANSI A156.4 – Door Controls – Door Closers.
 6. ANSI A156.5 – Auxiliary Locks and Associated Products.
 7. ANSI A156.6 – Architectural Door Trim.
 8. ANSI A156.7 – Template Hinge Dimensions.
 9. ANSI A156.8 – Door Controls – Overhead Holders.
 10. ANSI A156.13 – Mortise Locks and Latches.
 11. ANSI A156.15 – Closer Holder Release Devices.
 12. ANSI A156.16 – Auxiliary Hardware.
 13. ANSI A156.18 – Material and Finishes.
 14. ANSI A156.26 – Continuous Hinges.
 15. UL10C – Positive Pressure Fire Tests of Door Assemblies.
- B. Codes:
1. NFPA 101 – Life Safety Code.
 2. IBC 2003 – International Building Code.
 3. OBC 2007 – Ohio Building Code.
 4. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
 5. ADA – Americans with Disabilities Act.

1.03 SUBMITTALS

- A. General Requirements:
1. Submit copies of finish hardware schedule in accordance with Division 1, General Requirements.
- B. Schedules and Product Data:
1. Schedules to be in vertical format, listing each door opening, and organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended. Hardware schedule shall be submitted within two (2) weeks from date the purchase order is received by the finish hardware supplier. Furnish four (4) copies of revised schedules after approval for field and file use. Note any special

mounting instructions or requirements with the hardware schedule. Schedules to include the following information:

- a. Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
 - b. Handing and degree of swing of each door.
 - c. Door and frame sizes and materials.
 - d. Keying information.
 - e. Type, style, function, size, and finish of each hardware item.
 - f. Elevation drawings and operational descriptions for all electronic openings.
 - g. Name and manufacturer of each hardware item.
 - h. Fastenings and other pertinent information.
 - i. Explanation of all abbreviations, symbols and codes contained in schedule
 - j. Mounting locations for hardware when varies from standard.
2. Submit catalog cuts and/or product data sheets for all scheduled finish hardware products specific to this project. Do not include products that are not scheduled or specified.
 3. Submit separate detailed keying schedule for approval indicating clearly how the owner's final instructions on keying of locks has been fulfilled.
- C. Samples:
1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.
- D. Templates:
1. Furnish a complete list and suitable templates, together with finish hardware schedule to contractor, for distribution to necessary trades supplying materials to be prepared for finish hardware.
- E. Electronic Hardware Systems:
1. Shop Drawings: Details of electrified locking hardware, indicating the following:
 - a. Wiring Diagrams: Upon receipt of approved schedules, submit detailed wiring diagrams for power, signaling, monitoring, electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - 1) Elevation diagram of each unique access controlled opening showing interconnection of major system components.
 - 2) Point to point wiring diagram detailing all wiring and terminal connections between components in a system.
 - 3) System Operational Descriptions: Include description of component functions including, but not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.
 - b. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordinating related work.
 - c. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.
- F. Operation and Maintenance Manuals:

1. Upon completion of construction and building turnover, furnish two (2) complete maintenance manuals to the owner. Manuals to include the following items:
 - a. Approved hardware schedule, catalog cuts and keying schedule.
 - b. Hardware installation and adjustment instructions.
 - c. Manufacturer's written warranty information.
 - d. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.

1.04 QUALITY ASSURANCE

- A. Substitutions:
 1. All substitution requests must be submitted before bidding and within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and their hardware consultant.
- B. Supplier Qualifications:
 1. A recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the project's vicinity for a period of at least two (2) years.
 2. Hardware supplier shall have office and warehouse facilities to accommodate this project.
 3. Hardware supplier shall have in his employment at least one (1) Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project's hardware and requirements to the owner, architect and contractor.
 4. Hardware supplier must be an authorized factory distributor of all products specified herein.

1.05 FIRE-RATED OPENINGS

- A. Door Hardware for Fire Rated Openings:
 1. Provide door hardware for fire-rated openings that comply with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.
 2. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
 - a. Hardware required for fire doors shall be listed with Underwriters Laboratories for ratings specified.
 - b. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Marking and Packaging:
 1. Properly package and mark items according to the approved hardware schedule, complete with necessary screws and accessories, instructions and installation templates for spotting mortising tools. Contractor shall check deliveries against accepted list and provide receipt for them, after which he is responsible for storage and care. Any shortage or damaged good shall be made without cost to the owner.
 2. Packaging of door hardware is the responsibility of the supplier. As hardware supplier receives material from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set and door numbers to match the approved hardware schedule. Two or more identical sets may be packed in same container.
- B. Delivery:

1. The supplier shall deliver all hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor. Inventory door hardware jointly with representatives of hardware supplier and hardware installer/contractor until each is satisfied that count is correct.
2. No keys, other than construction master keys and/or temporary keys are to be packed in boxes with the locks.

C. Storage:

1. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.07 WARRANTY

- A. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
- B. Specific Warranties:
 1. Mortise locksets: Ten (10) years.
 2. Exit Devices: Five (5) years.
 3. Door closers: Ten (10) years.
 4. Continuous Hinges: Life of Installation.
 5. Continuous Hinge integral power transfer: Five (5) Years.
 6. Electrified hardware: Unlimited Lifetime.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

2.02 MATERIALS

- A. Screws and Fasteners:
 1. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.
 - a. Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior reverse bevel doors. Unless otherwise scheduled, supply one (1) hinge for every 30" of door height. Hinges shall be a minimum of 4 1/2" high and 4" wide; heavy weight hinges (.180) shall be supplied at all doors where specified.
 - b. Hinge Sizes: Provide the following hinges in widths sufficient to minimally clear trim. Thickness Size 2-1/4 inch Doors 5 inch by 5 inch 1-3/4 inch Doors – over 36 inches wide 5 inch by 4-1/2 inch 1-3/4 inch Doors 4-1/2 inch by 4-1/2 inch 1-3/8 inch Doors 3-1/3 inch by 3-1/2 inch.
 - 1) Specified Manufacturer: McKinney 2) Approved Substitutes: Hager, Stanley.
- B. Continuous Geared Hinges:

1. All hinges to be non-handed and completely reversible. Hinge line to be available in concealed flush mount with or without inset, full surface and half surface types as specified in the hardware sets. All hinges to be made of extruded 6060 T6 aluminum alloy with polyacetal thrust bearings, anodized after cutouts are made for bearings. All concealed hinges to be fire-rated for 20, 45 and 90 minutes when incorporated into proper door and frame labeled installations, without necessitating the use of fusible-link pins. All concealed hinges to be extra heavy duty weight unless otherwise listed in Hardware Set. All hinges to be factory cut for door size.
 - a. Specified Manufacturers: Pemko
 - b. Approved Manufacturers: McKinney, Select.
- C. Flush Bolts and Accessories:
 1. All manual and automatic flush bolts to be furnished as specified.
 - a. Specified Manufacturer: Rockwood.
 - b. Approved Substitutes: Burns, McKinney.
- D. Cylinders and Keying:
 1. Cylinders:
 - a. Provide cylinders and keys for Owner's existing interchangeable core key system.
 - 1) Specified Manufacturer: Corbin Russwin HS Pyramid – No Substitute.
 2. Keying:
 - a. All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the owner. The factory shall key all locks and cylinders.
 - b. Provide construction keyed cores for use during construction period. Verify quantity of required construction cores and keys with Construction Manager.
 - c. Furnish the following key amounts:
 - 1) Two (2) change keys per lock 2) Three (3) grand master keys 3) Six (6) master keys per master level 4) Fifteen (15) construction/temporary keys
 - d. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.
- E. Locking Decices:
 1. Mortise Locksets:
 - a. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Operational and Security Certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2 3/4" backset with a one-piece 3/4" anti-friction stainless steel latchbolt. The deadbolt shall be a full 1" throw made of stainless steel and have 2 hardened steel roller inserts. All strikes shall be non-handed with a curved lip. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.
- F. Lockset Strikes:
 1. Strikes shall be non-handed and available with curved lip, full lip or ASA type strikes as required. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.
- G. Electromagnetic Locks:
 1. Magnalocks:
 - a. Magnalocks shall operate on 24VDC input and shall not consume more than three (3) watts of power (150mA @ 24VDC). The magnalock shall be capable of providing a pull-apart or tensile holding force of at least 600 pounds. The strike plate shall be mounted using a steel sex bolt and roll pin to provide a "floating" movement to assure automatic self-alignment with the lock. Anti-tamper caps

shall be provided for the exposed holes. The lock and strike shall be plated to provide corrosion proofing. The lock shall be full sealed in resin to make it tamper and weather proof. The lock shall contain a suppression circuit to prevent residual magnetism and inductive kickback. The circuit also shall provide accelerated field collapse and radiation suppression. Ten feet of jacketed stranded conductor shall be provided for electrical connection.

- b. All electromagnetic locks shall be installed on the secure side of the door opening.
- c. Provide all necessary brackets, mounting plates, fillers, and backing / support in walls where required for proper installation and operation. 1) Specified Manufacturers: Securitron Model 62.

H. Exit Devices:

1. Conventional Devices – Push Rail:

- a. All exit devices shall be ANSI A156.3, Grade 1 Certified and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072" thick or stainless steel, brass, or bronze rail reinforced with steel channels. Push rails shall be constructed of 0.062" thick material. Lever trim shall be available in finishes and designs to match that of the specified locksets.
1) Specified Manufacturer: Corbin Russwin ED5200 Series.

I. Electrified Devices:

- 1. Electrified exit devices shall conform to all traditional exit device standards as specified above. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
- 2. All exit devices, both fire labeled and non-labeled devices, requiring electric dogging shall be held in the "dogged" or retracted position. All exit devices with electric latch retraction shall provide for a remote means of unlocking for momentary or maintained periods of time.
- 3. Exit devices with electrified trim shall be fail-secure unless otherwise specified.
- 4. Where specified exit devices shall be provided with a switch to monitor push rail or signal remote location and latchbolt monitoring.
 - a. Specified Manufacturers: Corbin Russwin – No Substitutions.

J. Door Closers:

1. Surface-Mounted Closers:

- a. All door closers shall be ANSI 156.4, Grade 1 Certified. All closers shall have aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power.
- b. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
1) Specified Manufacturer: Corbin Russwin – No Substitutions.

L. Door Trim and Protective Plates:

- 1. Push Plates: .062 in thickness. Beveled edges (B4E).
 - a. Size: 8 inch by 16 inch. Provide 4 inch by 16 inch where 8 inch by 16 inch is not applicable due to door conditions. b) Push plates shall have anti-microbial compound finish to suppress growth of bacteria, molds, and mildew.
- 2. Door Pulls: 1 inch round material, 18 inch screw centers, and 3-1/4 inch total projection with concealed screw mounting wherever through bolt attachment would leave an exposed screw. Provide reinforcement for hollow metal doors.
- 3. Door Pulls shall have anti-microbial compound finish to suppress growth of bacteria, molds, and mildew.

4. Push/Pull Plates: Push / Pull plates shall have anti-microbial compound finish to suppress growth of bacteria, molds, and mildew
 5. Kick plates shall be .062 gauge and two (2) inches less full width of door, or as specified.
 - a. Specified Manufacturer: Rockwood.
- M. Door Stops and Holders:
1. Wall-Mounted Door Stops:
 - a. Where a door is indicated on the plans to strike flush against a wall, wall bumpers shall be provided. Provide convex or concave design as indicated.
 - 1) Specified Manufacturers: Rockwood.
- N. Gasketing and Thresholds:
1. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
 2. Provide weatherstrip, door sweeps, and astragal sets with #6 x 5/8 pan head, stainless steel TEK Screws.
 3. Provide threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA).
 4. Thresholds shall have non-slip coating consisting of an abrasive finish of nickel-aluminum composite which is fused to the metal surface by an exothermic reaction.
 - a. Specified Manufacturers: National Guard.
 - b. Approved Substitutes: Pemko.
- O. Silencers:
1. Furnish rubber door silencers all hollow metal frames; two (2) per pair and three (3) per single door frame.
- P. Electronic Products and Accessories:
1. Power Supplies: Electromagnetic Locks.
 - a. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED's shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
 - 1) Specified Manufacturer: Securitron BPS.
- Q. Power Supplies: Electric Latch Retraction Exit Devices.
1. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. Power supplies shall be capable of providing amperage in-rush as power requirement from specific electric latch retraction exit device. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
 - a. Specified Manufacturer: Corbin Russwin 781N (specific to Corbin Russwin exit device).
- R. ADA Closers and Operators
1. Where "Low Energy Power Operated Doors" as defined by ANSI Standard A156.9,

- are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with ADA requirements.
2. Full closing force shall be provided when the power or assist cycle ends.
 3. Modular design, adjustments easily accessible from the front, UL listed for use on labeled doors.
 4. Shall have "Second Chance" function to accommodate momentary resistance, "Breakaway" function in the electronically controlled clutch, "Soft Start" motor control function and "Maintain hold-open switch" to hold the door open at 90 degrees.
 5. Shall have built in 12V and 24V power supply for actuators, card readers, electric strikes and magnetic door locks, as listed, inputs for both swing and stop side sensors and available to accept either 120VAC or 220VAC input power. All wiring connections between operator modules made by easy-to-handle electrical connectors. Shall comply with both UL and NEC requirements for Class 1 and Class 2 wiring by providing separate conduits for each.
 6. Shall have seven independent electronic adjustments to tailor the operator for specific site conditions. Opening speed, holding force at 90 degrees, sequential trigger and time delay, hold-open time at 90 degrees, opening force, clutch "break-a-way" force setting, electric strike trigger and time delay.
 7. Shall have separate and independent adjustments for backcheck, main speed and latch speed.
 8. Furnish actuators and other controls as shown in Hardware Sets.
 9. Wiring required by others:
 1. 115V, 60 Hz, 1 phase, 15 Amp supply to each door header.
 2. Wire and conduit between headers at vestibule for timers.
 3. Wire and conduit between actuators and units.
 10. Installation shall be by a company familiar with this operator and having experience in installing these operators using factory trained installers.

2.03 FINISHES

- A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Where specified hardware shall have an antimicrobial coating which permanently suppresses the growth of bacteria, algae, fungus, mold and mildew applied. The finish shall control the spread and growth of bacteria, mold and mildew and shall be FDA listed for use in medical and food preparation equipment.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Contractor shall ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

3.02 INSTALLATION

- A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
 - 1. Push Bar and Pull Sets - 42 inches from floor to centerline of door pull.
 - 2. Door Pulls - 42 inches from floor to centerline of door pull.
 - 3. Latchset strikes - 40 to 40-5/16 inches from floor to centerline.
 - 4. Deadlocks - maximum of 48 inches from floor to key and thumbturn.
 - 5. Push Plates - 42 inches from floor to centerline of plate.
 - 6. Exit Devices - Manufacturers recommended mounting location.
 - a. Exception: notify Architect of any conflicts between hardware and lite opening locations.
- B. All hardware shall be applied and installed in accordance with best trade practice by an experienced hardware installer. Care shall be exercised not to mar or damage adjacent work.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- D. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.03 FIELD QUALITY CONTROL

- A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: "The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the contract Documents give other specific instructions concerning these matters."
- B. Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall arrange and hold a jobsite meeting to instruct the installing contractor's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Architect and Owner.
- C. Architectural Hardware Consultant: Contractor will engage and pay for services of a certified Architectural Hardware Consultant (AHC) to perform inspections and to prepare inspection reports (not employed by the Supplier).
 - 1. 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.

3.04 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
- B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore to proper function and finish of hardware and doors.

Adjust door control devices to compensate for final operation of heating and ventilating equipment.

- C. Instruct owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of any electronic devices.

3.05 PROTECTION

- A. Contractor shall protect all hardware, as it is stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

3.06 HARDWARE SETS

HARDWARE SET 1A (Door 100A)

2 EA Continuous Hinge	SL11HD-RP	ALUM
1 EA Exit Device (Concealed Rods)	EL9847NL-OP	630
1 EA Exit Device (Concealed Rods)	9847EO-OP	630
2 EA Offset Pull	8190HD-2	630
1 EA Surface Closer	4021 4020-18G	689
1 EA Surface Door Operator	Besam SW200i	AL
2 EA Overhead Stop	1008	630
1 EA Power Transfer	EPT-2	
1 EA Power Supply		
1 EA Card Reader	By Others	
1 EA Cylinder		
2 Set Door Seals		
2 EA Door Sweep	C627A	ALUM
1 EA Threshold	8425 x Length	ALUM
2 EA Recessed Door Contacts	Refer to Electrical	
1 EA Actuator (exterior bollard)	8310-853T	32D
1 EA Actuator (vestibule wall)	8310-855 (dual button)	32D
1 EA Bollard Post (42x4x6)	8310-866 1866 Cap LCN	SILVER

HARDWARE SET 1B (Door 100B)

2 EA Continuous Hinge	SL11HD	ALUM
2 EA Dummy Push Bar	350	630
2 EA Offset Pull	8190HD-2	630
1 EA Surface Closer	4021 4020-18G	689
1 EA Surface Door Operator	Besam SW200i	AL
2 EA Overhead Stop	1008	630
2 Set Door Seals		
2 EA Door Sweep	C627A	ALUM
1 Actuator (interior wall)	8310-853T	32D
1 Actuator (vestibule wall)	See Hardware Set 1A	

HARDWARE SET 2
(Doors 103, 114, 126, 128)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Entry/Office Lock	B511D	626
1 EA Wall Stop	WS407CCV	630
1 Set Fire/Smoke Seal	9800 X 2525	GRY

HARDWARE SET 3
(Door 118)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Panic Device	18-R-P-VANGUARD	630
1 EA Rim Cylinder	20-022	626
1 EA Electric Strike	HES 9600	630
1 EA Surface Closer	4111 H SCNS	689
1 EA Power Supply		
1 EA Armor Plate	8400 38" x 1-1/2" LDW	630
1 Set Seal	120SA HEAD & JAMBS	628
1 EA Drip Strip	16A	628
1 EA Door Sweep	C627A	ALUM
1 EA Threshold	8425 x Length	ALUM
1 EA Recessed Door Contact	Refer to Electrical	

HARDWARE SET 4
(Gate 105A)

1 EA Electronic Digital Lock	Trilogy T2 DL2700IC	26D
3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
(Verify hinge with gate thickness, one hinge to be closer type)		

HARDWARE SET 5
(Doors 105B, 109, 111)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Classroom Latch	B110D	626
1 EA Electric Strike (109)	HES 5000-12/24D-501	630
1 EA Surface Closer	4011	689
1 EA Power Supply		
1 EA Wall Stop	WS407CCV	630
3 EA Silencer	SR64	GRY

HARDWARE SET 6
(Doors 110, 113, 115, 127)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Passage Latch	B101D	626
1 EA Wall Stop	WS407CCV	630
3 EA Silencer	SR64	GRY

HARDWARE SET 7

(Doors 116, 117)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Privacy Latch	B301D	626
1 EA Surface Closer	4011	689
1 EA Wall Stop	WS407CCV	630
3 EA Silencer	SR64	GRY

HARDWARE SET 8

(Door 112)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Passage Latch	B101D	626
1 EA Surface Closer	4011	689
1 EA Kickplate	8400 10" X 1-1/2" LDW	630
1 EA Wall Stop	WS407CCV	630
1 Set Smoke Seal	2525	GRY

HARDWARE SET 9

(Door 106)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Storage Latch	B581D	626
1 EA Surface Closer	4111 H SCNS	689
1 EA Armor Plate	8400 38" x 1-1/2" LDW	630
1 Set Seal	120SA HEAD & JAMBS	628
1 EA Drip Strip	16A	628
1 EA Door Sweep	C627A	28
1 EA Threshold	8425 x Length	ALUM
1 EA Recessed Door Contact	Refer to Electrical	

HARDWARE SET 10

(Door 108)

3 EA Hinge	BB1279 4-1/2x4-1/2NRP	652
1 EA Privacy Latch	B301D	626
1 EA Electric Strike	HES 5000-12/24D-501	630
1 EA Surface Closer	4011	689
1 EA Power Supply		
1 EA Wall Stop	WS407CCV	630
1 Set Smoke Seal	2525	GRY

HARDWARE SET 11

(Doors 102, 119, 120, 121, 122, 124)

All Hardware by Door Manufacturer

HARDWARE SET 12

(Door 107)

All Hardware and Pocket Door Frame by Pocket Door Manufacturer

MANUFACTURERS LIST

HINGES	McKINNEY, HAGER, SELECT
CLOSERS	CORBIN RUSSWIN, LCN
LOCKS	CORBIN RUSSWIN NO SUB
EXIT DEVICES	CORBIN RUSSWIN, VON DUPRIN
PUSH, PULL, STOPS	ROCKWOOD, IVES
THRESHOLDS	NATIONAL GUARD PRODUCTS
WEATHERSTRIP	NATIONAL GUARD PRODUCTS

END OF SECTION

SECTION 088000

GLAZING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass and glazing for the following products and applications:
 - a. Steel doors, frames and sidelights specified in Section 081110 - HOLLOW METAL DOORS AND FRAMES.
 - b. Aluminum frames and sidelights specified in Section 081200 - INTERIOR ALUMINUM FRAMES.
 - c. Glazed entrances, sliding doors, and storefronts specified in Section 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.
 - d. Interior borrowed lites.
 - e. Glass dividers at teller station.

1.02 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.

1.03 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 required by Code.
 - b. 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: 60 seconds or less.
 - c. 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, whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - d. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
 - 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, ambient; 180 deg F, 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 with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
 - 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 6.3 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.04 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: 12-inch-square Samples for each type of glass and glass assembly, glazing sealants.
- 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 type of glazing products:
- H. Warranties: Special warranties specified in this Section.

1.05 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..
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear 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. 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.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 2. Submit not fewer than eight 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 sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 - 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- G. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
 - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test, unless required by authorities having jurisdiction.

- H. 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] 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. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. 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.
- I. 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- J. 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.
- K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup for types of windows indicated, in locations shown on Drawings.
- L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.06 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.

1.07 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.

1.08 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the 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: Ten years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the 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 the 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: Ten years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.01 INSULATING-GLASS UNITS, EXTERIOR

- A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass, low-e coating on the No. 2 surface and argon gas filled. Provide one of the following or equal:
 - 1. VE1-2M by Viracon.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.25.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.
 - 2. Solarban 60 by Vitro Architectural Glass.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.24.
 - d. Shading Coefficient: 0.44.
 - e. Solar Heat Gain Coefficient: 0.38.
 - 3. SN-68 by Guardian Industries.
 - a. Visible Light Transmittance: 68 percent.
 - b. Reflectance Visible Light: 10 percent.
 - c. U Value (Winter): 0.245.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.

2.02 INSULATING-GLASS UNITS, INTERIOR

- A. Insulating-Glass Units for Vertical Glazing: 1 inch thick (25.0 mm) insulating glass consisting of two lites of 1/4 inch (6 mm) glass.

2.03 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.
- C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interpane air space, and complying with ASTM E2190 and with requirements specified in this Section.
 - 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" paragraph.
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. Butyl primary and silicone secondary sealants. Secondary sealant shall cover entire spacer bar at IGU perimeter.
 5. Spacer:
 - a. Exterior Units: Manufacturer's warm edge stainless steel spacer. Spacer corners shall be bent, soldered, or welded. Keyed spacer corners will not be accepted. Spacer may have a mid-span spacer key located at the midpoint of the insulating glass unit head. Where a mid-span spacer key is used, the key must be fully embedded (all sides) in butyl sealant.
 - b. Interior Units: Manufacturer's standard spacer.
- D. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 2. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 3. Interlayer Thickness: 0.030 inch.
 4. Interlayer Color: Clear.
- E. Glazing for DIRT Sliding Doors and Sidelites: As manufactured and installed by DIRT Wall Systems, Inc.

2.03 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Verify glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, interlayer of laminated glass, 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.
 4. Adhesives and sealants that are used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Structural Glazing Adhesives: 100 g/L.
 - b. Architectural Sealants: 250 g/L.
- 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- and Basic-Curing Silicone Glazing Sealants:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco Inc.; Spectrem 1.

- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.04 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.05 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. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.06 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.

3. PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 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 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 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.

3.04 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. 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.

3.05 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.

3.06 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.

END OF SECTION

SECTION 092110

GYPSUM BOARD ASSEMBLIES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels.
 - 3. Acoustic insulation in gypsum wallboard assemblies.
 - 4. Non-load-bearing steel framing.
 - 5. Installation of access panels.
 - 6. Marking and identification for fire and smoke partitions.
 - 7. See Specification Section 061000 Rough Carpentry and Framing for wood studs at exterior and other structural walls.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.
 - 1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
 - 1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 - 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 - 3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
 - 4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- C. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the jurisdiction of the project certifying proposed systems meet code requirements, project requirements and the following deflection criteria:
 - 1. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shaft.

1.04 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.
- C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 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.

1.06 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.

2. PART 2 PRODUCTS

2.01 WOOD FRAMING, GENERAL

- A. Structural and Nonstructural Framing Members, General: See Section 061000 – ROUGH CARPENTRY AND FRAMING.

2.02 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.

2.03 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inchwide flanges, 3/4 inch deep.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.04 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) Steel Network Inc. (The); VertiClip Series.
 - 3) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Soffit Framing: Short-span structural metal framing for interior soffit installation, including main runners and cross tees.
 - 1. Armstrong World Industries, Inc.; QuikStix Soffits.
- D. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.

1. Grace Construction Products; FlameSafe FlowTrak System.
 2. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 3. Metal-Lite, Inc.; The System.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.0312 inch.
- F. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0312 inch.
 2. Depth: 1-1/2 inches.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- I. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:
1. Basis of Design: Pliteq, Inc.; Genie Clip.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- L. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.05 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. USG Corporation; Sheetrock brand.
 2. Georgia-Pacific (G-P) Gypsum LLC; Tough Rock brand.
 3. National Gypsum Company; Gold Bond brand.
- B. Gypsum Wallboard: ASTM C 1396.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Fire-Resistant Type X: ASTM C 1396.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.06 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Gypsum Tile Backer Units: ASTM C 1178, with manufacturer's standard edges.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed; Diamondback Glas Roc tile backer.
 - b. Georgia-Pacific (G-P) Gypsum LLC; Dens Shield tile backer.
 - c. National Gypsum; Gold Bond eXP tile backer.
 - 2. Thickness: 5/8" or match adjacent gypsum wallboard.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 4. Where tile backer board are intended to be left without tile facing, skim coat entire surface to be exposed with compound material recommended by manufacturer.

2.07 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. Expansion (control) joint.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.08 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- 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.
- D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Tile Backing Panels: Use setting-type taping compound and setting-type, sandable topping compound.

2.09 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound Attenuation Blankets: 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 requirements of assembly.
- E. Acoustical Sealant: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - c. USG Corporation.; SHEETROCK Acoustical Sealant.
 3. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.

2.10 IDENTIFICATION LABELS FOR FIRE AND SMOKE PARTITIONS

- A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. My Safety Sign.
 - c. Safety Supply Warehouse.
 2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS"

3. PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754. 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.

3.04 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - a. Do not attach hangers to steel roof deck.
 - b. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

- c. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- d. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within $1/8$ inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.05 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 doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum $1/2$ -inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 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 o.c.
- D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
 - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.06 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.07 APPLYING INTERIOR GYPSUM BOARD

- A. 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 to minimize end joints.
 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.
- B. 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 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.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- D. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.08 APPLYING TILE BACKING PANELS

- A. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.09 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.
 2. LC-Bead: Use at exposed panel edges.
 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.10 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 and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 4. Level 5: Where indicated on Drawings.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.12 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, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093000

TILING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Floor tile at Restrooms.
 - 2. Wall tile at Restrooms.
 - 3. Tile base at Teller Counter.
 - 4. Elastomeric sealants for expansion, contraction, control, and isolation joints in tile surfaces.
 - 5. Surface preparation for tile and accessories.

1.02 DEFINITIONS

- A. Module Size: Actual tile size plus joint width indicated.
- B. Face Size: Actual tile size, excluding spacer lugs.

1.03 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.
 - 2. Step Treads: Minimum 0.6.
 - 3. Ramp Surfaces: Minimum 0.8.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
 - 1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
 - 3. Stone thresholds in 6-inch lengths.
 - 4. Metal edge strips in 6-inch lengths.
- D. Qualification Data: For Installer.
- E. Material Test Reports: For each tile-setting and -grouting product.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Waterproofing.
 - 3. Joint sealants.
 - 4. Metal edge strips.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid additives in unopened containers and protected from freezing.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

2. PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
 - 3. Large Format Tiles are defined as more than 8 inches in any nominal dimension.
- B. Porcelain Floor Tile: ANSI A137.
 - 1. Floor Tile (CT-1): **Crossville Bluestone, 12x 24.**
- C. Porcelain Wall Tile: ANSI A137.
 - 1. Tile Wainscot at Restrooms:
 - a. Field Tile (CT-2): **Daltile Matte 4x4 Desert Gray X714.**

- b. Accent Tile (CT-3): **Daltile Semigloss 4x4 Waterfall 0169.**
 - c. Accent Tile (CT-4): **Daltile Semigloss 4x4 Galaxy 1469.**
- 2. Tile Base at Teller Counter (CT-5): **Crossville Color Blox Bullnose A1119 Night Night, 4x12.**
- D. Patterns:
 - 1. As shown on Drawings.
- E. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- F. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- G. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- H. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.
- I. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; extruded aluminum exposed-edge material, with clear anodized satin finish.
 - 1. Available Manufacturer: Schluter Systems.
- J. Marble Thresholds: Uniform, fine- to medium-grained white stone with gray veining, ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish. Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
- K. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- L. Flexible Latex-Portland Cement Mortar (Medium Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - 2. Basis-of-Design Product: MAPEI; Kerabond/Keralastic System.
 - 3. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
- M. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Laticrete International, Inc.

- e. MAPEI Corporation.
 - f. Summitville Tiles, Inc.
 - g. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
 - a. For glass tile wall applications, provide white color mortar.
- N. Joint Grout: ANSI A118.7.
- 1. Manufacturers:
 - a. Bonsal American, Inc: www.sakrete.com
 - b. Bostik Inc: www.bostik-us.com.
 - c. Custom Building Products: www.custombuildingproducts.com.
 - 2. Epoxy Grout: ANSI A118.8, modified epoxy emulsion grout, manufacturer's full range of colors as selected; use for wall and floor applications.
- O. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- P. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
- Q. Accessory Materials: Waterproofing/Crack Isolation Membrane Basis of Design or equal.
- 1. TEC HydraFlex Waterproofing Crack Isolation Membrane manufactured by Specialty Construction Brands, Inc. www.tecspecialty.com
 - a. Exceeds ASNI A118.10 Specifications for Waterproof Membranes.
 - b. Exceeds ASNI A118.12 Specification for Crack Isolation.

2.02 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated. Comply with applicable requirements in Section 079200 JOINT SEALANTS.
- 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
- 1. Available Products:
 - a. Custom Building Products; 100 Silicone Caulk.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones; Sanitary 1700.
 - d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - e. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
- 1. Available Products:
 - a. Bostik; Chem-Calk 550.
 - b. Tremco, Inc.; Vulkem 245.

- c. Pecora Corporation; NR-200 Urexpan.
- d. Tremco, Inc.; THC-900.

2.03 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINTSEALANTS.
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
 - 2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.04 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
 - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
- B. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.05 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

3.06 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical ceiling tiles and panels.
 - 2. Suspension systems, grid systems and ceiling hangers.
 - 3. Acoustical sealant at edge moldings at acoustical ceilings.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Manufacturers' product data for sealants, including printed statement of VOC content.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- 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 square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.
- D. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the production site.
- E. Maintenance Data: For finishes to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
 - 2. Suspension Systems: Obtain each type through one source from a single manufacturer.
- B. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- 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 complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
- D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 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.

1.05 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.

1.06 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.

2. PART 2 PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

- 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. Armstrong World Industries, Inc.
 2. Ecophon, by CertainTeed.
 3. USG Corporation.
 4. National Gypsum Company.
- B. Acoustical Panels Type 1 (ACT-1): **Armstrong, Inc.; Georgian Beveled Tegular.**

1. Size: 24 inch x 24 inch x 5/8 inch.
2. Edge profile: Beveled Tegal.
3. Color: White.
4. Fire Resistance: Class A.
5. Sag Resistance: HumiGuard Plus.
6. Ceiling Grid: Prelude 15/16 inch exposed tee grid system, white.
7. Substitutions: Equivalent products by other manufacturers will be considered. The architect will be the sole judge of equivalence.

C. Acoustical Panels Type 2 (ACT-2): **National Gypsum Company; Gold Bond Gridstone Fire-Shield Gypsum Ceiling Panels.**

1. Size: 24 inch x 24 inch x 1/2 inch; 2 mil white stipple-textured vinyl laminate surface.
2. Edge profile: Square edge.
3. Color: White.
4. Fire Resistance: Class A.
5. Sag Resistance: Sag resistant gypsum core.
6. Ceiling Grid: Prelude 15/16 inch exposed tee grid system, white.
7. Substitutions: Equivalent products by other manufacturers will be considered. The architect will be the sole judge of equivalence.

2.02 ACOUSTICAL AND ACCENT CLOUD

- A. Armstrong Formations Acoustical Cloud with Axiom Vector; Custom Cloud.
1. 28'-0" length x 4'-0" width.
 2. MetalWorks Effects Wood Look Panels, color as selected by Architect from manufacturer's full range.
 3. Suspension System Type: Prelude, color as selected by Architect from manufacturer's full range.
 4. Axiom Type and Height: Axiom Vector, 6" (AV6).
 5. Axiom and Suspension System Color: as selected by Architect from manufacturer's full range.

2.03 METAL SUSPENSION SYSTEMS

- A. Suspension Systems: Provide suspension systems complying with requirements of ASTM C635 for Intermediate Duty Systems. Provide suspension system to suit ceiling tiles specified. Provide lay-in suspension systems with 100% accessibility. Locate accessible tiles where required or field directed for access to controls, valves and equipment.
- B. Attachment Devices: Provide and size for 5 times design load indicated in ASTM C635, Table 1, direct hung.
- C. Hanger Wire: ASTM A641, galvanized steel wire, soft temper, prestretched, class 1 coating, minimum 12 gage. Size wire so that stress at three times hanger design load given in ASTM C635, Table 1, Direct Hung, will be less than the yield stress of the wire.
- D. Hold-Down Clips: At vestibules, drive-thru and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.04 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

B. Suspension Trim: Match existing.

2.05 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

3. PART 3 EXECUTION

3.01 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 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. 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.
 6. Do not attach hangers to steel deck tabs.
 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. 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. 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.
 2. 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.

3.04 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

SECTION 096500

RESILIENT FLOORING AND BASE

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, the following:
 - 1. Vinyl composition tile flooring, standard and static dissipative type.
 - 2. Resilient wall base.
 - 3. Resilient reducer strips and trim pieces.
 - 4. Subfloor preparation.

1.02 PERFORMANCE REQUIREMENTS

- A. Static-Dissipative Properties: Provide floor coverings with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
 - 1. Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage or ESD-STM-7.1.
 - a. Average greater than 1 meg ohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
 - b. Average no less than 1 meg ohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
 - 2. Static Decay: 5000 to 0 V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material and product used. Provide certifications stating that materials comply with requirements and applicable fire ratings.
- B. Shop Drawings: For each type of floor covering. Include floor covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
 - 2. Submit grounding diagram showing location of grounding strips and connections.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide flooring samples having minimum area of 144 square inches. Provide 6 inch lengths of base and trim pieces.

1.04 QUALITY ASSURANCE

- A. Source: For each type of flooring product required for the work of this section, provide primary materials and products which are the products of one manufacturer. Provide secondary materials such as adhesives which are acceptable to the manufacturers of the primary materials.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 PROJECT CONDITIONS, SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Environment: Perform work only when temperature and humidity conditions are within the limits established by manufacturers of the materials and products used. Provide continuous exhaust through vent windows during cement/adhesive application.
- C. Substrates: Proceed with work only when substrate construction and penetrating work is complete. To the greatest extent possible, perform work of this section after other finishing operations such as painting have been completed.
- D. Subfloors: Ensure that concrete subfloors are properly cured and sufficiently dry by making bond and moisture tests as recommended by flooring manufacturer. Coordinate work of this section with work of Section 033000, Cast-In-Place Concrete, to ensure that concrete curing compounds used do not interfere with adhesion of resilient flooring.

1.07 MAINTENANCE STOCK

- A. Provide packaged, wrapped and labeled maintenance stock equal to 50 linear feet of base and 150 square feet of each type of flooring.

2. PART 2 PRODUCTS

2.01 VINYL COMPOSITION FLOORING

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Azrock Commercial Flooring, a brand of Tarkett Inc.
 - 3. Mannington Mills.
- B. Vinyl Composition Tile, Standard Type: 1/8 in. thick, 12 in. by 12 in. tile, meeting or exceeding ASTM F 1066, Comp. 1, Class 2 -Through Pattern; equal to Excelon, by Armstrong.
 - 1. Basis of Design (VCT-1): **Armstrong Imperial Texture Standard Excelon Classic White 51911.**
- C. Vinyl Composition Tile, Static Dissapative Type: 1/8 in. thick, 12 in. by 12 in. tile, meeting or exceeding ASTM F 1066, Comp. 1, Class 2 -Through Pattern; equal to Excelon SDT, by Armstrong.
 - 1. Basis of Design (VCT-2): **Armstrong Excelon SDT Armor Gray 51951.**

2.02 RESILIENT WALL BASE

- A. Resilient Wall Base: Provide rubber wall base by Roppe conforming to ASTM F 1861, Group 1, Type TP, and as follows:
 - 1. Basis of Design: **Roppe Smoke 174.**
 - 2. Height: 4 in. typical.
 - 3. Thickness: 1/8 in. gage.
 - 4. Style: Top-set cove at resilient flooring (Style B Cove), straight at carpet (Style A Straight). Provide formed corners.
 - 5. Finish: Matte.
 - 6. Roll Lengths: 100 ft. rolls, continuous runs with no pieces less than 10 ft. in any run over 100 ft.

2.03 ACCESSORIES

- A. Adhesives, Low-VOC, Low-Odor Type without Solvents: Provide adhesive recommended by flooring and base manufacturer for substrate indicated, or one of the following:
 - 1. Advanced Air Tech Adhesives, as manufactured by Advanced Adhesive Technology Inc., Dalton, GA, telephone 706/226-0610.
 - 2. SAF-T Series, as manufactured by Capitol USA, Dalton, GA, telephone 800/831-8381, www.capitolusa.com.
 - 3. Safe-Set Series, as manufactured by Chicago Adhesive Products Co., Romeoville, IL, telephone 800/621-0220; www.chapco-adhesives.com.
 - 4. Safe-Coat Series, as manufactured by American Formulating & Manufacturing Co., San Diego, CA, telephone 800/239-0321; www.afmsafecoat.com.
 - 5. Envirotec Healthguard Adhesives, by W.F. Taylor Co., Inc., Fontana, CA, telephone 800/868-4583; www.wftaylor.com.
 - 6. GreenLine Series, as manufactured by The W.W. Henry Co., Aliquippa, PA 15001, telephone 800/232-4832; www.wwhenry.com.
 - 7. Ultra/Bond ECO Series, as manufactured by Mapei Corporation, Deerfield Beach, FL 33442, telephone 800/426-273; www.mapei.com.
- B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor covering system to ground connection.
 - 1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR, Subpart D (EPA Method 24):
 - a. VCT Adhesives: Not more than 50 g/L.
- C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor covering system to ground connection.
- D. Leveling Compound: Provide low VOC, latex based leveling, patching and filling compound that is recommended by flooring manufacturer and compatible with adhesives used where applicable.
- E. Concrete Sealer: Provide a low VOC primer/sealer, as recommended by flooring manufacturer and compatible with adhesives used where applicable.
- F. Vinyl and Rubber Edging: 1 in. wide, length as required, tapered, maximum thickness same as flooring, solid vinyl or rubber, as selected from manufacturer's standard plain colors, as produced by manufacturer of flooring product used, or other manufacturer whose products meet all the Architect's requirements and are approved by Architect for use on the Project.

3. PART 3 EXECUTION

3.01 INSPECTION

- A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Beginning work means Installer accepts substrates and conditions.

3.02 PREPARATION

- A. Manufacturer's Recommendations: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Clean: Vacuum clean subfloors immediately before installation.

- C. Level: Check subfloor/underlayment tolerances and fill holes, depressions and cracks with leveling compound. Do not scrape, grind, or sand down existing tiles containing asbestos.
- D. Bond Test: Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry to receive flooring within the limits specified by flooring manufacturer.
 - 1. Randomly adhere 3 ft. x 3 ft. panels of specified flooring materials spaced about 50 ft. apart throughout areas to receive resilient flooring. Install test panels with adhesives to be used in the actual installation.
 - 2. If panels are securely bonded after 72 hours, installation work may proceed.
 - 3. If panels are not securely bonded, reclean substrates and repeat test until adequate bond is achieved.
- E. Subfloor Preparation: Repair minor holes, cracks and depressions using leveling compound. Sand ridges and high spots level. Clean subfloor surfaces and vacuum immediately before installation. If concrete subfloors are excessively dusty or powdery, spray apply sealer to concrete surfaces to prevent dusting problems through flooring.
- F. Primers: Apply primer prior to application of adhesive if recommended by manufacturer for porous or powdery subfloors.

3.03 TILE INSTALLATION

- A. Manufacturer's Recommendations: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
 - 1. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor covering surfaces to ground connections.
- B. Color Control: Maintain uniformity of color and pattern; use flooring from same manufactured lots.
- C. Extent: Extend work into closets, toe spaces and similar areas. Provide flooring on covers and other items within floor areas. Cut flooring neatly around fixtures and obstructions. Terminate flooring at the centerline of doors when adjacent finish is dissimilar to avoid seeing dissimilar material when door is closed.
- D. Edges: Provide securely bonded resilient edge strips where indicated and wherever edge of floor would otherwise be exposed.
- E. Tile Flooring: Lay tile flooring from room centerlines with grain in same direction. Avoid use of less than 1/2 tile pieces. Adhere with full coverage of adhesive observing the manufacturer's recommended trowel notching spreading rates and open times. Roll floor with 150 pound roller to ensure good contact and bond.

3.04 RESILIENT BASE INSTALLATION

- A. Base: Adhere base to walls, columns, casework, and all other permanent surfaces and fixtures. Install base in rolls to minimize seams. Tightly bond base to walls without any gaps between wall and base and with 100% coverage of adhesive. Hand roll base to ensure full contact and adhesion. Field form sharp external corners and keep seams and joints as far from external corners as possible. Cut and cope base at internal corners; do not round internal corner with base.
 - 1. Fill top edge of base with sealant where base runs along an irregular wall surface such as masonry. Sealant color shall closely match base color.

3.05 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to test electrical resistance of static-control

resilient floor covering systems for compliance with requirements.

1. Arrange for testing after installation static-control adhesives have fully cured and floor covering systems have stabilized to ambient conditions and after ground connections are completed.
- B. Static-control resilient floor coverings will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove excess adhesives immediately. Remove and replace work that cannot be successfully repaired or cleaned.
- B. Prohibit traffic over newly installed flooring for at least 48 hours. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.
- C. Clean floors and base in strict compliance with manufacturer's instructions and recommendations immediately before final acceptance.

END OF SECTION

SECTION 096800

CARPETING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Walk-off carpet.
 2. Carpet tile.
 3. Carpet accessories.
 4. Substrate preparation for carpet and accessories.

1.02 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. Carpet tile type, color, and dye lot.
 3. Type of subfloor.
 4. Type of installation.
 5. Pattern of installation.
 6. Pattern type, location, and direction.
 7. Pile direction.
 8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- 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: 24-inch-square Sample, or one full size tile.
 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch-long Samples.
 3. Carpet Seam: 12-inch Sample.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. 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.

1.03 QUALITY ASSURANCE

- A. Carpeting Standard: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard," 2011 edition, formerly CRI 104 "Standard For Installation Specification Of Commercial Carpet."

- B. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- C. 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.
- D. Mockups: Before installing carpet tile, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI Carpet Installation Standard, Section 5, "Storage and Handling."

1.05 PROJECT CONDITIONS

- A. General: Comply with CRI Carpet Installation Standard, Section 7, "Site Conditions."
- 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 equipment or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.06 WARRANTY

- A. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

2. PART 2 PRODUCTS

2.01 CARPET

- A. Carpet Products (See Finish Schedule for locations):
 - 1. Walk-Off Carpet Tile (CPT-1): **Mannington Ruffian II Ebony Earth 1506 (Monolithic).**
 - 2. Carpet Tile (CPT-2): **Interface Furrows II Volcanic Ash 9218 (Monolithic).**

2.02 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 with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
- C. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

3. PART 3 EXECUTION

3.01 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: Comply with CRI Carpet Installation Standard, Section 9, "Testing Concrete Substrates." 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. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with CRI Carpet Installation Standard, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- 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 flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
 - 3. Moisture Vapor Emission Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
 - 4. Relative Humidity Testing:
 - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
 - 5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.

- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. Carpet Sheet, Direct-Glue-Down Installation: Comply with CRI Carpet Installation Standard, Section 13, "Direct Glue-Down Installation."
 - 1. Carpet Sheet, Stair Installation: Comply with CRI Carpet Installation Standard, Section 17, "Carpet on Stairs" for glue-down installation.
 - 2. Comply with carpet sheet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- B. Carpet Tile: Comply with CRI Carpet Installation Standard, Section 18, "Modular Carpet," and with carpet tile manufacturer's written installation instructions.
 - 1. Installation Method: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
 - 2. Maintain dye lot integrity. Do not mix dye lots in same area.
- C. 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.
- D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. Do not bridge building expansion joints with carpet.
- 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.

3.04 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 and HEPA filter.
- B. Protect installed carpet tile to comply with CRI Carpet Installation Standard, Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 097200

WALL COVERINGS

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical wall covering at vault.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
 - 1. Low-Emitting Materials:
 - a. For adhesives, submit test results, including TVOC emissions and VOC content, or GreenGuard Gold certifications.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- C. Samples for Verification: Full width by 3 ft. long section of wall covering.
 - 1. Sample from same print run or dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
- D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.
- E. Qualification Data: For qualified testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
- G. Maintenance Data: For wall coverings to include in maintenance manuals.

1.02 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with test protocol and criteria in the 2015 IBC.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.

1.03 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the manufacturer for full drying or curing.

2. PART 2 PRODUCTS

2.01 ACOUSTICAL WALL COVERING

- A. Acoustical Wall Covering Products:
 - 1. **Crosspoint Fabrics Tiara II 251CR Pier Point**

2.02 INSTALLATION ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.
 - 1. VOC content of 50 g/L or less.
- B. Primer/Sealer: Mildew resistant as recommended in writing by wall-covering manufacturer for intended substrate.
- C. Seam Tape: As recommended in writing by wall-covering manufacturer.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.03 INSTALLATION

- A. General: Comply with wall covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
- B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- E. Match pattern 6 ft. above the finish floor.
- F. Install seams vertical and plumb at least 6 in. from outside corners and 6 in. from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
- G. Apply adhesive to the substrate only, and allow to tack dry. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- H. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.04 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 099100
PAINTING AND COATING

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, painting and finishing of all exposed surfaces, both interior and exterior, except the following:
1. Factory finished items, except as noted.
 2. Finished metal surfaces of stainless steel, copper, brass, and bronze.
 3. Finished metal surfaces that are color anodized or plated.
 4. Surfaces in concealed areas such as crawl spaces, above ceilings and the like.
 5. Moving parts, code required labels, and equipment data plates.
 6. Mechanical and electrical items not in public spaces.
 7. Acoustical ceiling systems.
 8. Exterior metal mesh panel systems.
 9. Exterior decorative high-pressure compact laminate (HPL) panel systems.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, paint analysis, application instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements and that paint products used are the highest quality produced by the manufacturer.
- B. Initial Selection Samples: Submit color swatches showing complete range of colors and finishes available for each paint and finish system.
- C. Verification Samples: Before painting mock-ups, submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.

1.03 INTENT

- A. A major intent of the work of this section is to finish all work in the project that is exposed to view and not located in concealed areas, crawl spaces and the like.

1.04 QUALITY ASSURANCE

- A. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide thinners and other secondary materials which are acceptable to the manufacturers of the primary materials.
- B. Mock-ups: Before beginning primary work of this section, provide 100 square feet mock-ups of each color and paint system at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this section to serve as criteria for acceptance of this work.

1.05 TESTS

- A. Testing Agency: The Owner may employ an independent testing agency to perform tests, evaluations and certifications. Cooperate and permit samples of materials to be taken as they are used. The Contractor shall pay all costs of tests which show failure to comply with Contract Documents.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from freezing and damage.
- B. Avoid the possibility of fire by removing flammable materials, solvents and spirits from the project site or by storing materials in UL approved fire-resistive cabinets. Keep work area free from flammable waste and soiled rags.
- C. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 PROJECT CONDITIONS

- A. Weather, Temperature, and Humidity: Perform work only when existing and forecasted conditions are within the limits established by manufacturers of the materials and products used.
 - 1. Indoor Temperature: Maintain minimum interior temperature of 65°F during application and drying of paints and until occupancy of the building.
- B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.
- C. Ventilation: Comply with manufacturer's requirements and recommendations.
- D. Lighting: Since lighting conditions can change the appearance of the work, work only when permanent lighting system is operational and in use.

1.07 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Coordinate this work with work specified in other sections. Furnish information on finish materials to be used in the field to ensure that correct prime coats are used in the shop.

2. PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Latex and Alkyd Based Paints: Provide products of one of the following manufacturers that meet or exceed specified requirements:
 - 1. Benjamin Moore and Co. (Moore).
 - 2. ICI Dulux Paint Centers (ICI).
 - 3. PPG High Performance Coatings (PPG).
 - 4. The Sherwin Williams Company (S-W).
- B. High Performance Paint Coatings: Provide products of one of the following manufacturers that meet or exceed specified requirements:
 - 1. DuPont.
 - 2. Tnemec Company, Inc. (Tnemec).
 - 3. Porter International (Porter).
 - 4. Sherwin Williams (S-W).
- C. High Performance Metallic Interior Paint Coatings: Provide products of one of the following

manufacturers that meet or exceed specified requirements:

1. Matthews Paint (a division of PPG Industries), Delaware, OH 43015;
www.corporateportal.ppg.com/na/refinish/matthews.
2. Metallic Paint Collection, by Modern Masters Inc., Sun Valley, CA 91352;
www.modernmastersinc.com.
3. Solid Metal Scuffmaster Architectural Finishes, by Master Coating Technologies, St. Paul, MN 55121; www.scuffmaster.com.

- D. Materials used shall be best grade products of their respective kinds. The Painting Schedule is based on products the above named manufacturers. These are specified to establish a standard of quality and kind of material desired. Provide these products, or equals as approved by Architect.
- E. If substitutes are proposed, submit complete schedule showing materials specified and equivalent materials proposed as substitutes. Provide complete manufacturer's product data on proposed materials. Substitutes must be approved by Architect before commitment for materials is made.
- F. Assume full responsibility for proper performance of materials, for method of application, and for compatibility of materials applied over shop coats or other coats previously applied, including but limited to primers, sealers, preservative treatments, etc. Notwithstanding specific schedules in this Section, select primers which have been verified to be appropriate for each of the substrates and finishes encountered.
- G. Provide miscellaneous painting materials such as linseed oil, shellac, turpentine, and thinner of the highest quality.

2.02 COLORS

- A. Provide colors in accordance with schedule provided by Architect. Tint and match colors to the satisfaction of Architect. Provide facilities for comparison and adjustment of colors. No limit is placed on number of colors that may be required; however the following maximum number of colors may be used in any one room, area, or surface:
1. Interior: Four colors.

2.03 FILLERS, SOLVENTS, AND MISCELLANEOUS MATERIALS

- A. Turpentine: Pure gum spirits of turpentine conforming to Fed Spec. TT-T-801.
- B. Drier: Conform to Fed. Spec. TT-D-65.
- C. Tinting Materials: Best quality, ground in pure boiled linseed oil, limeproof, and non-fading.

3. PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Inspection: The Applicator shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Applicator accepts substrates and conditions.
- B. Responsibility: The Applicator shall be solely responsible for the finishing work and shall prepare substrates as needed to obtain the highest quality finished surfaces.
- C. Manufacturer's Recommendations: Strictly comply with manufacturers' instructions and

recommendations, except where more restrictive requirements are specified in this section.

- D. Cleaning: Do not finish over dirt, rust, grease, moisture and other conditions detrimental to formation of a durable finish film. Clean surfaces to remove dirt, oil, grease, mildew, asphalt, concrete splatters, and all other foreign substances.
- E. Removal and Protection: Remove finished hardware, fixtures, accessories, and similar items or provide adequate protection to ensure that these surfaces are not finished or splattered. Replace these items when finishing work is completed.
- F. Shop Primers: Remove incompatible primers and reprime or provide barrier coats in compliance with finish manufacturer's instructions. Metal to receive spray fireproofing shall not be primed and as noted on drawings.
- G. Masonry and Concrete: Prepare materials by removing laitance, efflorescence, form release agents, and surface glaze by cleaning and washing as recommended by finish manufacturer and approved by Architect. Brush surfaces to remove loose particles. Allow a minimum of 60 to 90 days curing time before finishing poured and precast concrete. Allow a minimum of 30 to 60 days curing time before finishing concrete masonry. Determine substrate alkalinity and moisture content and, if necessary, take appropriate remedial actions as recommended by manufacturers of primary finish materials.
- H. Wood: Prepare wood surfaces by sanding smooth, sealing knots, setting nails and fasteners, and filling holes, cracks, and imperfections with putty acceptable to finish manufacturer. For transparent finished work, use putty and filler color matched to wood to minimize its appearance. Seal and backprime all interior and exterior woodwork immediately after delivery to site and before installation.
- I. Ferrous Metal: Prepare shop primed metal surfaces by solvent wiping, sanding and touching-up shop prime coats. Prepare bare metal surfaces in accordance with Steel Structures Painting Council SP-6. Remove welding flux and splatter, burrs, and all other surface defects and foreign substances. Clean surfaces by washing with water followed by phosphate rinsing. Apply prime coats immediately after completion of cleaning.
- J. Galvanized Metal: Aggressively clean new galvanized surfaces with grease cutting solvent, such as undiluted vinegar, to remove fabricating oils. Touch-up abraded surfaces immediately with zinc-rich paint or rust-inhibiting paint acceptable to the Architect.
- K. Aluminum: Solvent clean surfaces equal to SSPC SP-1. Do not use red lead primers on aluminum surfaces.
- L. Doors: Finish tops, bottoms, and edges of doors the same as door faces.
- M. Drywall: Clean surfaces free from dust and foreign substances. Joint treatment materials shall be thoroughly dry. Paint metal corner beads and trim with metal primer before application of water based finish coatings

3.02 APPLICATION

- A. Manufacturer's Recommendations: Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Material Preparation: Mix and prepare materials in strict compliance with manufacturer's recommendations. Do not thin materials without Architect's approval. Keep foreign substances out of finishing materials.
- C. Primers: Provide primers as recommended by finish system manufacturer for substrates encountered. Tint all primers and undercoats to the approximate shade of the finish coat,

making each coat slightly darker and closer to the finished shade. Use deep base primers for deeptone, bright, and accent colors. Prime surfaces immediately after surface preparation to prevent contamination of substrate.

- D. Application: Apply paint and finish systems as scheduled using brushes, rollers, or painter's mitts. Spray application of paint and finish systems is not acceptable for field work, except for variegated paint systems. Apply finish materials at coverage rates and dry film thicknesses recommended by their manufacturers. Provide additional coats as needed to eliminate all show through and bleed through areas.
- E. Extent: Finish all surfaces behind removable items. Finish inside of ducts and grilles with flat black paint when these surfaces are visible. Finish surfaces of access doors, panels and covers that are visible when opened with same finish and color as face panels.
- F. Sanding: Sand before application and between coats as recommended by finish system manufacturer.
- G. Recoat Time: Allow manufacturer's recommended waiting period between successive coats.
- H. Finish Appearance: Provide uniform final finishes, free of runs, sags, wrinkles, streaks, shiners, brush/roller marks, color variations and other imperfections.
- I. Mock-Up Matching: Provide final finishes which exactly match approved mock-ups.

3.03 FIELD QUALITY CONTROL

- A. Testing: The Owner reserves the right to employ an independent testing agency to conduct material evaluation and application tests. The Contractor shall cooperate fully and, when requested, permit samples of materials to be taken from containers as the materials are applied to building surfaces.
- B. Cost of Testing: If tests indicate that materials or work does not comply with requirements, the Contractor shall pay for tests performed, all retesting, and shall remove and replace non-complying work.

3.04 TOUCH-UP, CLEANING, AND PROTECTION

- A. Touch-up damaged coatings and finishes to eliminate evidence of repair.
- B. Clean finished surfaces and remove all finish splatters from adjacent work. Remove and replace work that cannot be successfully cleaned.
- C. Provide signs and temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

3.05 PAINT SCHEDULE

- A. Number of coats scheduled is minimum. Refer to Paragraph 3.02D, hereinbefore.
- B. The following finish systems refer to products of Tnemec Co. and Benjamin Moore, unless indicated otherwise. Provide these systems or comparable systems from specified manufacturers.

3.06 EXTERIOR PAINT SCHEDULE

- A. Exterior Painted Wood and Wood Trim for Latex Semi-Gloss Finish:

1. One Coat Duron Bond N-Seal Exterior Acrylic Latex Primer 08-124.
 - a. PPG SunProof Primer.
 - b. S-W SuperPaint VinylSafe Exterior Latex Acrylic Flat A80 series or Satin A89 series.
 2. Two Coats Duron Weathershield Ext. 100% Acrylic Semi-Gloss House Paint.
 - a. PPG Sun-Proof Exterior Semi-Gloss Latex 78 line.
 - b. S-W SuperPaint VinylSafe Exterior Latex Acrylic Satin A89 series.
- B. Exterior Ferrous Metal:
Surface Preparation: SSPC-SP6)
Coat 1: Tnemec Series 594 Omnithane (shop applied) at 3.0 mils DFT
Coat 2: Tnemec Series N69 Hi-Build Epoxoline II at 3.0 mils DFT
Coat 3: Tnemec Series 1080 Endura-Shield WB at 3.0 mils DFT
- C. Exterior Non-Ferrous Metal:
(Surface Preparation: SSPC-SP1 followed by SSPC-SP3 or 7)
Coat 1: Tnemec Series N69 Hi-Build Epoxoline II at 3.0 mils DFT
Coat 2: Tnemec Series 1080 Endura-Shield WB at 3.0 mils DFT
- D. Exterior Galvanized Metal:
(Surface Preparation: SSPC-SP7 Brush-off Blast)
Coat 1: Tnemec Series N69 Hi-Build Epoxoline II at 2.5 – 3.0 mils DFT
Coat 2: Tnemec Series 1075 Endura-Shield at 2.5 – 3.0 mils DFT
- E. Exterior Aluminum (Where Required):
(Surface Preparation: SSPC-SP#1 and sanding with Scotch Bright pads)
Coat 1: Tnemec Series N69 Hi-Build Epoxoline II at 2.0 mils DFT
Coat 2: Tnemec Series 1070 Flouronar at 2.0 mils DFT

3.07 INTERIOR PAINT SCHEDULE

- A. Interior Gypsum Wallboard and Plaster for Eggshell Finish:
- | | |
|-----------|---|
| One Coat | 1. Moore Ecospec Interior Latex Primer Sealer (231) |
| | 2. Duron Genesis Latex Primer |
| | 3. S-W Harmony Latex Wall Primer |
| | 4. PPG Pure Performance Latex Primer |
| Two Coats | 1. Moore Pristine Ecospec Interior Latex Eggshell (223) |
| | 2. Duron Genesis Latex Eggshell |
| | 3. S-W Harmony Latex Eggshell |
| | 4. PPG Pure Performance Latex Eggshell |
- B. Interior Gypsum Wallboard and Plaster Ceilings for Flat Finish:
- | | |
|-----------|---|
| One Coat | 1. Moore Ecospec Interior Latex Primer Sealer (231) |
| | 2. Duron Genesis Latex Primer |
| | 3. S-W Harmony Latex Wall Primer |
| | 4. PPG Pure Performance Latex Primer |
| Two Coats | 1. Moore Pristine Ecospec Interior Latex Flat (219) |
| | 2. Duron Genesis Latex Flat |
| | 3. S-W Harmony Latex Flat |
| | 4. PPG Pure Performance Latex Eggshell |
- C. Interior Gypsum Wallboard and Plaster for Latex Semi-Gloss Finish:
- | | |
|----------|---|
| One Coat | 1. Moore Ecospec Interior Latex Primer Sealer (231) |
|----------|---|

- 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Wall Primer
 - 4. PPG Pure Performance Latex Primer
- Two Coats
 - 1. Moore Pristine Ecospec Interior Latex Semi-Gloss (224)
 - 2. Duron Genesis Latex Semi-Gloss
 - 3. S-W Harmony Latex Semi-Gloss
 - 4. PPG Pure Performance Latex Semi-Gloss
- D. Interior Architectural Woodwork, Finish Carpentry, and Wood Doors for Latex Semi-Gloss Paint Finish (softwoods, paint grade hardwoods, MDO, and hardwood veneers):
 - One Coat
 - 1. Moore Ecospec Interior Latex Primer Sealer (231)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Primer
 - 4. PPG Pure Performance Latex Primer
 - Two Coats
 - 1. Moore Pristine Ecospec Interior Latex Semi-Gloss (224)
 - 2. Duron Genesis Latex Semi-Gloss
 - 3. S-W Harmony Latex Semi-Gloss
 - 4. PPG Pure Performance Latex Semi-Gloss
- E. Interior Architectural Woodwork, Finish Carpentry and Millwork for Satin Transparent Finish (all hardwoods and hardwood veneers, except paint grade and factory-finished items):
 - Sand 120 grit sandpaper.
 - Sand 220 grit sandpaper.
 - Stain
 - 1. Carver Tripp Waterbase Stain
 - 2. Knute's Restoration EF Waterbase Stain
 - 3. American Formulating & Manuf., SafeCoat Durostain
 - Two Coats
 - 1. Bona Kemi USA, Bona Tech Mega Waterbase Polyurethane
 - 2. Target Coatings, Oxford Hybrid Satin Varnish
 - 3. American Formulating & Manuf., Polyureseal BP
 - Sand Between 220 grit sandpaper.
 - Urethane Coats
- F. Interior Concrete Masonry Units for Latex Semi-Gloss Finish in Dry Areas:
 - One Coat
 - 1. Moore Latex Block Filler (13 g/l VOC formulation)
 - 2. ICI Bloxfil (67g/l VOC formulation)
 - 3. PPG Speedhide Int/Ext Latex Block Filler (28g/l VOC formulation.)
 - 4. S-W Block Filler (43g/l VOC formulation)
 - Two Coats
 - 1. Moore Pristine Ecospec Interior Latex Semi-Gloss (224)
 - 2. ICI Latex Semi-Gloss
 - 3. S-W Harmony Latex Semi-Gloss
 - 4. PPG Pure Performance Latex Semi-Gloss
- G. Interior Metals (Not specified to receive other coating systems/not shop finished):
 - One Coat
 - 1. Approved primer, in shop under other Sections (where specified)
 - One Coat
 - 1. Moore Ecospec Interior Latex Primer Sealer (231)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Wall Primer

4. PPG Pure Performance Latex Primer

Note: One prime coat only is required at interior metal work, except touch-up of areas which have become rusted or damaged prior to finish painting.

- Two Coats
1. Moore Pristine Ecospec Interior Latex Semi-Gloss (224)
 2. Duron Genesis Latex Semi-Gloss
 3. S-W Harmony Latex Semi-Gloss
 4. PPG Pure Performance Latex Semi-Gloss

H. Penetrating Sealer of Concrete at Floors:

- One Coat
1. Curecrete Chemical Co. "Ashford Formula" at 50 sq. ft. per gallon

I. Interior Exposed Concrete and Concrete Masonry Unit Walls: (Surface Preparation: Mechanically abrade surfaces to remove sheen from existing surfaces and clean, per manufacturer's requirements.)

- One Coat
1. S-W Loxon Block Surfacers/Primer Seal stains with S-W PrepRite ProBlock Primer Sealer

- Two Coats
1. S-W Pre-Catalyzed Waterbased Epoxy, 1.5 mils DFT each coat, gloss to be selected by Architect.

J. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork: Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 101123
TACKABLE WALL SURFACES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Tackable wall surfaces at teller stations.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Tackable Wall Surfaces: Show sizes, profiles, construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Samples for Verification: For units with factory-applied color finishes as follows:
 - 1. Actual sections of tack assembly.
 - 2. Swatches of tackable surface material.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of Linoleum Surface.
- E. Maintenance Data: For tack assemblies to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain each type of product through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of bulletin boards 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.
- D. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. PART 2 PRODUCTS

2.01 MATERIALS

A. Linoleum resilient tackable surface material.

B. SBR Solvent free adhesive.

2.02 WALL-MOUNTED TACK BOARD

A. Basis of Design: **Forbo Industries, Bulletin Board 2187 Brown Rice.**

1. Width: As indicated on Drawings.
2. Height: As indicated on Drawings.
3. Depth: 1/4", self healing.
4. Mounting: Adhered to substrate with adhesive approved by tack surface and substrate manufacturer.

2.03 FABRICATION

A. Fabricate tack boards to requirements indicated for dimensions, design, thickness and finish of materials.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine walls and partitions for proper backing for tack boards.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install tack boards in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Install as single piece. Seams will not be acceptable.

3.03 ADJUSTING AND CLEANING

- A. Wash finish with common neutral pH cleaner. Rinse with clear water.

END OF SECTION

SECTION 101400

SIGNAGE

1. PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Construction Drawings, Instructions to Bidders, General Conditions, Special Conditions and Division 1 - General Requirements apply to this section.

1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Code-required interior panel signage, including but not limited to accessibility signage, toilet room signage and mechanical and electrical room signage.

1.03 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.
- C. 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. Approved samples will not be returned for installation into Project.
- D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.05 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.

1.06 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.

2. PART 2 PRODUCTS

2.01 PANEL SIGNS

- A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:
 - 1. Code-Required Signs for Certificate of Occupancy:
 - a. Type: Photopolymer on acrylic, or printed acrylic
 - b. Colors: Two contrasting colors to be selected by the Architect from manufacturer's full range.
- B. 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. Raised-Copy Thickness: Not less than 1/32 inch.
- C. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque non-reflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.02 ACCESSORIES

- A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
- B. 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.

3. PART 3 EXECUTION

3.01 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 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.

3.02 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 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.
- 3.03 CLEANING AND PROTECTION
- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Architect.

END OF SECTION

SECTION 102200
DEMOUNTABLE PARTITIONS

1. PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Construction Drawings, Instructions to Bidders, General Conditions, Special Conditions and Division 1 - General Requirements apply to this section.

1.02 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Aluminum framing system.
 - 2. Glazing materials.
 - 3. Sliding glass doors.
 - 4. Hardware.

1.03 COORDINATION

- A. Scheduling: Manufacturer production time shall not exceed four weeks from date of receipt of approved shop drawings.
- B. Preinstallation Meeting Attendees and Procedures: Conduct meeting one week, minimum, before starting Work of this Section.

1.04 SUBMITTALS

- A. Product Data
 - 1. Demountable partition system components. Mark required options. Include standard details applicable to Project.
 - 2. Doors and hardware.
 - 3. Glazing.
 - 4. Accessories.
- B. Shop Drawings
 - 1. Plans, elevations, sections, and details.
 - 2. Show anchorages to other construction, including concealed supports in walls.
 - 3. Electrical layout (locations only).
 - 4. Door locations, hardware, and details.
- C. Samples: Provide manufactures standard size samples for verification of support system and each type, color, and texture of exposed finish, full thickness:
 - 1. Aluminum Extrusion Components.
 - 2. Cladding Finishes.
 - 3. Linear Trim and Base.
 - 4. Door Face Finishes.
 - 5. Glass.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Partitions and facing.

- B. Warranty Documentation: For specified system.
- C. Installation drawing: Indicating final locations of components.

1.06 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturers: Specialize in designing and manufacturing stick-built partitions and have production facilities capable of single-source responsibilities and warranty.
 - 2. Installers: Manufacturer or approved by Manufacturer.
- B. Certifications: From Contractor for sound transmission characteristics.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver products until building is enclosed.
- B. Store products inside building.
- C. Protect components and finishes from damage.
- D. Handle in accordance with the manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Ambient Conditions: Perform work within following limitations:
 - 1. Building enclosed and environmental systems maintaining design conditions for Owner occupancy.
 - 2. Temperature: 60 degrees F (15.5 C), minimum, 90 maximum degrees F (32.2 C), maximum.
 - 3. Humidity: 25 percent, minimum, 55 percent, maximum.
- B. Existing Conditions: Verify site dimensions before project approval and fabrication. Show site dimensions on production drawing.

1.09 WARRANTY

- A. Manufacturer Warranty
 - 1. Partition System Components: Repair or replacement of defective components of site assembled structure, cladding system and components.
 - 2. Warranty Period: 10-year limited warranty.

2. PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer: Falkbuilt Ltd.
- B. Acceptable Substitution: DIRT.

2.02 SYSTEM DESCRIPTION

- A. Factory fabricated, site installed partitions, including:
 - 1. Sliding doors, glazing, hardware, and accessories.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Stick-built partitions shall be capable of withstanding the effects of gravity loads, dead loads, and the following loads and stresses within limits and under conditions indicated:
 - 1. Deflection: Lateral deflection tested under a uniformly distributed load of 5 psf (0.24 kN/m²), maximum.
 - a. Solid Walls: L/120.
 - b. Glass Walls: L/175 or 3/4 inch (19 mm) whichever is less.
 - 2. Seismic Performance: Partitions shall withstand effects of seismic events without collapse, loss of anchorage, or loss of panels.
- B. Surface-Burning Characteristics: Tested in accordance with ASTM E84 by a qualified independent testing agency.
- C. Acoustical Performance: Provide stick-built partitions with STC rating indicated, determined by testing to ASTM E90 and classified in accordance with ASTM E413.

2.04 FRAMING SYSTEM

- A. Description: Modular system for partitions that can be readily dismantled and reinstalled in other locations.
- B. Framing, Fixed Glazed Wall System: ASTM B221 Alloy 6063-T6 Extruded aluminum.
 - 1. Product:
 - a. Lydia: Non-adjustable glass wall.
 - b. Kai: Adjustable glass wall.
 - 2. Profile Dimensions:
 - a. Base Height: [1-1/2 inches (38.1 mm)][2-1/2 inches (63 mm)].
 - b. Head Height: 2-1/2 inches (63 mm).
 - c. Width: 2-1/2 inches (63 mm).
 - d. Frame Depth: 4 inches (101.6 mm).
 - 3. Glass Thickness: 3/8 inch (10 mm).
 - 4. STC Rating: N/A.
 - 5. Finish: Clear Anodized.
 - 6. Leveler Stem: Manufacturer's standard screw adjusted leveling system.
 - a. Base Adjustability Range: Plus or minus 1/2 inch (13 mm).
 - b. Head Adjustability Range: Plus or minus 1 inch (25 mm).
 - 7. Fasteners: Zinc plated steel, type F.

2.05 GLAZING MATERIALS

- A. Safety Glazing Labels: Permanent certification label in visible location of SGCC or other agency acceptable to authorities having jurisdiction.
- B. Base Glass:
 - 1. Clear Glass: ASTM C1036, Type I, Class 1, Quality-Q3.
 - b. Tempered Glass: Kind FT.

2.06 DOOR AND FRAMES

- A. Sliding Doors
 - 1. Glass Sliding Doors
 - a. Glass: 3/8 inch (10mm) tempered.
 - b. Frame: All-Glass / Frameless.
 - c. Slide Guide: Manufacturer supplied top aluminum rail and floor guide.

- B. Continuous track mounted to partition frame system.

2.07 HARDWARE

- A. Hardware
 - 1. Bar Pull: Non-locking.
 - a. Length: 24 inch (600mm).
 - b. Diameter: 1-1/4 inch (31.50mm).
 - c. Finish: Brushed stainless steel.

2.08 ACCESSORIES

- A. Connections and Supports: Manufacturer's standard connections and supports that connect and release from floor and ceiling without damage:
 - 1. Carpet grippers.
 - 2. Ceiling track clips.
- B. Cladding Joint Closure: Manufacturer's standard closure trim, capable of closing up to a 25 mm (1 inch) gap.

2.09 FABRICATION

- A. Framing.
 - 1. Fabricate components for installation with concealed fasteners and pressure fit.
 - 2. Fabricate components for concealed anchorage and assembly fasteners.
 - 3. Where partitions join fixed construction or require sound attenuation, use manufacturer's standard seals around perimeter.
- B. Panels: Fabricate to size before delivery.
- C. Prepare doors and frames for hardware.

2.10 STAINLESS STEEL FINISHES

- A. Stainless Steel: NAAMM AMP 503, Number 4 satin directional.

2.11 ALUMINUM FINISHES

- A. Anodizing: AAMA 611 Class I or AAMA 612 with electro-deposition organic seal.
 - 1. Color: Clear.

3. PART 3 EXECUTION

3.01 INSTALLERS

- A. Manufacturer of partitions, or manufacturer approved and trained installer.

3.02 EXAMINATION

- A. Verify locations of concealed construction for support and anchorage.
- B. Verify that openings are plumb, level, and square.
- C. Verify that floor and ceiling surfaces are in plane.

3.03 PREPARATION

- A. Clean floor, wall, and ceiling contact surfaces.
- B. Vacuum clean carpet below sill members.

3.04 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's installation instructions.
 - 2. Do not cut metal components except where trimming is indicated on Shop Drawings.
 - 3. Install system without gaps at joints with other construction.
- B. Framing:
 - 1. Install framing plumb, accurately aligned, and free of warp or twist.
 - 2. Install components with securely fastened full-contact joints.
 - 3. Anchor framing system rigidly and securely to adjacent construction without damaging surfaces.
 - 4. Install perimeter gaskets without gaps to provide continuous light and acoustical seals.
- C. Glazing:
 - 1. Install glass panels per factory-numbered sequence.
 - 2. Install glass on resilient setting blocks in glazing channels.
 - 3. Install glazing gaskets with joints only at corners and to provide continuous barrier to air and sound.
- D. Sliding Doors:
 - 1. Align track for smooth, quiet operation.
 - 2. Adjust end stops for accurate closed and fully open positions.
- E. Tolerances:
 - 1. Plumb: 1/8 inch (3 mm) maximum deviation.
 - 2. Plane: 1/8 inch (3 mm) maximum deviation in 12 feet (4 m).
 - 3. Level: 1/8 inch (3 mm) maximum deviation in 12 feet (4 m) for top of sill.

3.05 CLEANING

- A. Clean in accordance with the manufacturer's instructions.
 - 1. Do not use alkaline or abrasive agents.
 - 2. Do not scratch or mar finishes.
- B. Provide new replacements for components that are damaged or have soiling or staining that cannot be satisfactorily cleaned.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Manufacturer's Authorized Representative will coordinate demonstration with Owner's staff.

3.07 PROTECTION

- A. Protection: Protect from damage through the duration of construction activities.

END OF SECTION

SECTION 102800
TOILET ACCESSORIES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Toilet accessories, as scheduled on the Drawings. Coordinate with Owner for accessories furnished by Owner.

1.02 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. 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.
- C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.03 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.

1.04 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.

2. PART 2 PRODUCTS

2.01 TOILET AND BATH ACCESSORIES

- A. Toilet Paper Dispensers (TP): Where this designation is indicated, provide toilet tissue dispenser complying with the following:
1. Products: Bradley #5105 or equal.
 2. Type: Single-roll dispenser.

3. Mounting: Recessed with concealed mounting.
 4. Material: Stainless steel #304.
- B. Paper Towel Dispenser (PT): Furnished and installed by Owner.
- C. Soap Dispensers (SD): Furnished and installed by Owner.
- D. Grab Bars (GB): Where this designation is indicated, provide stainless-steel grab bar complying with the following:
1. Products: Bradley #812 or equal.
 2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
 3. Mounting: Concealed with manufacturer's standard flanges and anchors.
 4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
 5. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.
- E. Sanitary Napkin Disposal Units (SND): Where designation is indicated, provide stainless steel sanitary napkin disposal unit complying with the following:
1. Products: Bradley #4781-15 or equal.
 2. Surface Mounted Type: Seamless exposed walls, self-closing top cover, locking bottom panel, stainless steel continuous hinge, and removable, reusable receptacle.
- F. Mirrors (MR): Where this designation is indicated, provide mirror unit complying with the following:
3. Products: Bradley #780-1836 or equal.
 4. Stainless Steel: Fabricate frame from minimum nominal 0.05-inch- (1.3-mm-) thick stainless-steel angles, with square corners mitered, welded, and ground smooth.
- G. Mop and Broom Holders (MH): At service sink locations, provide mop and broom holder complying with the following:
1. Products: Bradley #9984 or equal.
 2. Mop and Broom Holder with Utility Shelf and hooks: 36-inch- (762-mm-) long unit fabricated of minimum nominal 0.05-inch- (1.3-mm-) thick stainless steel with shelf; support brackets for wall mounting; three hooks for wiping rags; four spring-loaded, rubber hat, cam-type, mop/broom holders mounted on front of shelf; and approximately 1/4-inch- (6-mm-) diameter, stainless-steel rod suspended beneath shelf for drying rags.

2.02 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch 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 Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. 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.

2.03 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 the Owner.

3. PART 3 EXECUTION

3.01 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, when tested according to method in ASTM F 446.

3.02 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

SECTION 104400

FIRE PROTECTION SPECIALTIES

1. PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for portable fire extinguishers.
 - 3. Mounting brackets for fire extinguishers.

1.02 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.04 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

2. PART 2 PRODUCTS

2.01 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.02 FIRE-PROTECTION CABINET

- 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. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Material: Enameled-steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Trimless with Plaster Stop: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop. If wall condition does not allow for trimless with plaster stop, provide flat 5/16 inch trim of same material as the cabinet box.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Door Material: Steel sheet with baked enamel finish, color as selected.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered break glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet, or provide locking mechanism that allows for emergency access to the cabinet without the breaking of glass, simply by pulling sharply on the cabinet's handle.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.03 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.04 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
 - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.05 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. Finish fire-protection cabinets after assembly.
- D. 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.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.
 - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply vinyl lettering at locations indicated.

3.04 INSTALLATION OF FIRE-RATED CABINETS

- A. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
- B. Seal through penetrations with firestopping sealant as specified in Section 078410 - PENETRATION FIRESTOPPING.

3.05 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

DIVISION 22 - PLUMBING
TABLE OF CONTENTS

<u>SECTION #</u>	<u>SECTION TITLE</u>	<u># PAGES</u>
<u>Plumbing</u>		
22 0000	Basic Plumbing Requirements.....	14
22 0513	Common Motor Requirements for Plumbing Equipment	2
22 0519	Gauges for Plumbing Piping	2
22 0523	General Duty Valves for Plumbing Piping	3
22 0529	Hangers and Supports for Plumbing Piping and Equipment	3
22 0553	Identification for Plumbing Piping and Equipment.....	4
22 0719	Plumbing Piping Insulation	6
22 1116	Domestic Water Piping	7
22 1119	Domestic Water Piping Specialties	3
22 1313	Facility Sanitary Piping	7
22 1319	Sanitary Waste Piping Specialties	3
22 1600	Facilities Natural Gas Piping.....	1
22 3300	Electric Domestic Water Heaters	3
22 4000	Plumbing Fixtures.....	7

SECTION 22 0000 – BASIC PLUMBING REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 01 – General Requirements are part of this Section as if written in full herein. Contractor is held to have familiarized himself with these provisions contained therein.

PART 2 – SCOPE OF WORK

2.01 WORK INCLUDED

- A. The work included by these Specifications is intended to include the furnishing of all labor, materials and equipment required for, or reasonably incidental to, the complete installation of the plumbing and piping systems as hereinafter specified and as indicated on the Drawings. The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. Unless otherwise specifically stipulated, the term "Furnish and Install Complete" shall be considered a part of each Section.
- B. In general, the work shall include but not be limited to the following items:
 - 1. All necessary excavation and backfill required for work covered by this Section of the Specifications.
 - 2. Cutting and patching required for work covered by this Section of the Specifications.
 - 3. Sanitary waste and vent piping within the building to a point 5'-0" outside the building as indicated, including final connection.
 - 4. Cold and hot water piping to fixtures and equipment including final connection.
 - 5. Natural gas piping system within building, regulators, valves and final connection to equipment.
 - 6. Condensate drain piping from mechanical cooling units as required.
 - 7. Complete plumbing fixture and equipment installation.
 - 8. Water heater.
 - 9. Pipe sleeves, escutcheon plates and hangers.
 - 10. Permits, inspections, tests and fees related to this work.
 - 11. Valves on all systems.
 - 12. Insulation.
 - 13. Housekeeping pads and bases.
 - 14. Chlorination, testing, adjustment and cleaning of all systems and equipment.
 - 15. All interlock wiring.
 - 16. Submittals.
 - 17. Instruction of Owner's Personnel and operating manuals.
 - 18. Warranty.

PART 3 - WORK DONE BY ANOTHER TRADE CONTRACTOR

- A. Work done by another trade contractor shall include the following items:
1. Electrical power wiring.
 2. Painting.
 3. Motor starters and disconnects, except as noted.
 4. Exterior to building catch basin, manhole, storm and sanitary piping.
 5. Exterior to building water service.

PART 4 - ITEMS FURNISHED BY OTHERS

- A. All fixtures and units preceded by the letter number P-1 shall be furnished by Owner or another Trade Contractor. Plumbing Contractor to rough-in for, install and make all final connections. Provide traps, supplies, etc. to make equipment operable.

PART 5 – EXECUTION

5.01 PERMITS AND INSPECTIONS

- A. Contractor shall secure all required permits, shall pay for all inspections required by controlling authorities, and shall pay all charges in connection with his work.

5.02 SITE VISITATION

- A. It is strongly recommended that all Bidders visit and examine the site.
- B. No additional compensation will be awarded for deviations or discrepancies. Contractor shall become familiar with all conditions under which work must be performed, and shall check all present elevations.
- C. The Contractor shall report any major discrepancies to the Architect. Failure to report such discrepancies shall be deemed acceptance of existing conditions.

5.03 ORDINANCES AND CODES

- A. All work shall be installed in accordance with the local regulations and State Codes and shall receive the approval of the inspection department having jurisdiction. The Drawings and Specifications constitute the minimum acceptable requirements.
- B. Should any work shown on the Drawings or herein specified be contrary to said minimum requirements, ordinances, statutes or regulations, the work shall be executed in accordance with the requirements, ordinances, statutes or regulations, but not until the points in question have been referred to the Architect for approval.

- C. All tests shall be made as required by above mentioned requirements, ordinances, statutes or regulations, or by the inspector having jurisdiction. The cost of such tests shall be included in the Contract Price and evidence of such tests and inspections shall be provided for the Owner's files.
- D. Reduction of Lead in Drinking Water Act (PL 111-380): Products intended to dispense water for human consumption through drinking or cooking shall comply with the following:
 - 1. A weighted average lead content of not more than 0.25% as determined by NSF/ANSI 372, and
 - 2. NSF/ANSI 61.
 - 3. Product shall be certified compliant with these requirements by an American National Standards Institute (ANSI) accredited certification organization.
 - 4. Acceptable Product Marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

5.04 WARRANTY

- A. The Contractor shall warrant his workmanship and materials for a period of one (1) year from the date of final acceptance by the Architect or beneficial use by the Owner, whichever occurs first. The work shall be left in perfect order at completion and should defects develop within the warranty period, the Contractor shall, upon notice of same, remedy the defects and reimburse the Owner for all damage to the other work, whether caused by the defects or the work of correcting same.
- B. By mutual agreement, the Owner may occupy or use a portion or portions of the work prior to total project completion. Acceptance of any work by the Architect shall be accomplished by the issuance of a Certificate of Substantial Completion, a copy of which shall be promptly sent to the Contractor. From the date of issuance of such certificate, the Contractor shall be relieved of his obligation to maintain the portion of the premises accepted, but shall remain obligated to correct any "punch list" items uncorrected. The Contractor shall also continue to be responsible for all latent defects covered by the warranty described above, and shall continue to carry insurance to protect both the Owner and the Contractor's firm for workmen engaged on contingency items.
- C. Contractor should note that portions of this project may be used for temporary heating and plumbing and this shall not void or shorten the warranty period. Maintenance of equipment during construction shall be the responsibility of each Mechanical Contractor. All warranties, whether equipment, materials, etc., if used during construction or not, shall be under a warranty period of one (1) year after final acceptance of the project or beneficial use by the Owner, whichever occurs first. Any such defects noted during the warranty period shall be promptly rectified by the Contractor without expense and with a minimum of inconvenience to the Owner.

- D. The Contractor shall guarantee free and unrestricted flow of fluids without objectionable noise, and shall further guarantee all pipes and specialties to remain free from objectionable and/or substantial leaks during the warranty period.
- E. By entering into or accepting this Contract, the Contractor guarantees proper operation in accordance with the true intent of these Drawings and Specifications. If the Contractor is not satisfied that the requirements will make the guarantee possible, the Contractor shall submit with the bid a brief statement of such changes desired to have made therein which will enable the Contractor to give the guarantee.
- F. Certificates of approved final inspections by the authorities having jurisdiction shall be available for the Owner.

5.05 COMPLETION AND ACCEPTANCE

- A. When the Contractor is satisfied that all work required by Drawings and Specifications for the Contractor's division of the Contract has been completed, notification shall be given to the Architect that this is substantially correct. The Contractor will be notified immediately as to acceptance or rejection of the notification.
- B. Upon acceptance of this notification, the Owner's Representative will conduct a final observation of the work (punch list) to determine what items remain in an unacceptable condition. A report of this observation will be delivered to the Contractor as soon as possible following acceptance of the Contractor's letter of completion.
- C. Upon receipt of the final punch list items, the Contractor shall take immediate corrective action on all items. When all items on the list have been corrected to the satisfaction of the Architect, the final "Contract Completion Certificate" shall be executed. See General Conditions of these Specifications.

5.06 DRAWINGS

- A. In general, Drawings are schematic in nature, are intended as a guide to the Contractor, and do not necessarily show all details, offsets, etc. All Drawings are to be thoroughly inspected. For construction purposes, Drawings should not be scaled.

- B. The Contractor's work shall conform to the information contained in this Specification and/or as indicated in the latest revision to the Drawings referred to therein. The Contractor shall consult with the Architect regarding all questions which may be in doubt before proceeding with fabrication of parts affected. The Contractor shall prepare all additional detail or field installation drawings necessary at the Contractor's own expense. The Contractor shall verify all dimensions and conditions indicated on the layout Drawings and determine if any changes are required in piping runs, drains, ducts, etc. to avoid interference. Major changes shall not be made without the approval of the Architect.
- C. While the Drawings are to be adhered to as closely as possible, the Contractor has the right to vary the run of piping during progress of the work as may be found necessary or desirable to avoid interferences. Major revisions shall be verified with the Architect.
- D. In general, the Specifications are written in the singular form. The Drawings should be used to determine the number of items required for a complete installation.

5.07 VERIFICATION

- A. Before running any piping within the building, this Contractor shall assure that they can be installed as contemplated without trapping or interfering with columns, beams, piping, fixtures, etc. Contractor to verify all measurements and conditions at job site before proceeding with the work. Any necessary major deviation shall be referred to the Architect for adjustment before lines are run, at no increase in contract price.
- B. Of necessity, openings, supporting steel, field-built curbs, electrical data, space requirements, etc. were designed around specific parameters. When the Contractor determines the make of equipment to be provided for the job, it shall be the Contractor's responsibility to verify and coordinate unit dimensions with the General Contractor and all other interested Contractors on the job. It shall also become the Contractor's responsibility to change as necessary, through the Architect, all required dimensions so that openings, supporting steel, curbs, electrical data, etc. will fit the equipment supplied. Any additional cost will be the sole responsibility of this Contractor.
- C. In addition, electrical power, interlock and control diagrams and piping arrangements were designed around one specific manufacturer. If additional wiring, piping, controls, etc. are required for other equipment, this Contractor shall include the cost of same in his price.

5.08 WORKMANSHIP AND LAYOUT

- A. All work shall be done by mechanics skilled in the particular trade involved, under responsible supervision, and with the best modern practices.

- B. Contractor shall consult all drawings, construction details and job site and confer and cooperate with other Contractors and the Owner to avoid interferences.
- C. All materials shall be new and of the grade and quality specified. Only the best material of each class specified shall be used.
- D. The General Contractor will provide pipe shaft openings in the new construction where shown on the architectural or structural drawings and also where indicated and sized by this Contractor. Openings required due to untimely or inaccurate layout by the Contractor shall be at the Contractor's own expense using skilled workmen and the proper tools for the work involved.

5.09 CUTTING AND PATCHING

- A. All cutting and patching of, or repair of damage to work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place or existing construction, or who causes damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay all costs of such cutting or repair. All patching required to match existing adjacent construction shall be by the General Contractor at the Contractor's expense.
- B. No structural members shall be cut without the approval of the Architect and any such cutting shall be done in a manner directed by the Architect.

5.10 PROTECTION

- A. The Contractor shall provide approved protection for all work included in this Contract and be responsible for damage of any kind to fixtures, piping or other work. At the completion of the project, the Contractor shall remove all protection and replace all damaged work without expense to the Owner.
- B. In addition to the normal precautions for protection of work, Contractor shall provide various types of protection as follows:
 - 1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and an oil proof floor cover.
 - 2. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
 - 3. Protect equipment and finished surfaces from paint droppings, insulation adhesive and sizing droppings, etc. by use of drop cloths.
- C. All pumps, motors and other rotating equipment shall be stored at the site with openings, bearings, etc. covered to exclude dust and moisture. All stock piled pipe shall be placed on dunnage and protected from weather and from entry of foreign material.

- D. During construction, open ends of pipes, equipment, etc. shall be capped or plugged to reduce dirt accumulation inside.

5.11 MANUFACTURER'S DIRECTIONS

- A. Manufacturer's directions shall be followed in all cases where the manufacturer of articles used in this Contract furnish directions covering specific points for the installation, startup, operation or maintenance of these articles. Directions in conflict with the Drawings or the Specifications shall be referred to the Architect for clarification.

5.12 RECORD DRAWINGS

- A. Contractor shall keep an accurate record of all deviations from Contract Drawings. The Contractor shall neatly and correctly enter, in colored pencil, any deviations on Drawings affected during the progress of the project and shall keep Drawings available for inspection.
- B. At completion of job and before final acceptance, make any final corrections to Drawings and deliver same to the Architect.

5.13 CLEAN-UP

- A. Contractor shall frequently clean up all refuse, rubbish, scrap materials and debris caused by the Contractor's operations to the end that at all times the site shall present a neat, orderly and workmanlike appearance. Crates and cartons in which materials, equipment or fixtures are received shall be removed daily.
- B. If, in the opinion of the Architect, neatness is not maintained, the Architect may have the area cleaned as defined in the General Conditions.
- C. Contractor, at the completion of the work, shall remove all surplus material, false work, temporary structures, including foundations thereof and debris of every nature resulting from their operations and put the site in a neat and orderly condition.
- D. In addition to ordinary precautions in keeping pipes and equipment clean and free of debris during construction, the Contractor shall make provisions for cleaning out pipes making use of the greatest velocities available. The Contractor shall provide attendance, temporary connections and filters as required.
- E. The exterior of pipes and equipment shall be cleaned of all dirt and grease, preparatory to insulation or painting.

5.14 TESTING AND ADJUSTMENT

- A. All work installed under this contract shall be tested in the presence of and to the satisfaction of the inspecting authority having jurisdiction and the Architect.

- B. All ductwork, piping or equipment not found tight under test shall be reworked or replaced, as directed.
- C. Contractor shall operate all parts of the entire system, make any and all adjustments and repairs, and shall leave the entire work tested and ready for operation by the Owner and/or operation and final testing and balancing by the Testing and Balancing Subcontractor.
- D. If the installed equipment does not meet the specified capacities (cfm, heat output, cooling output, etc.) or if the motor operating current exceeds the nameplate ratings, such equipment shall be corrected by the Contractor.

5.15 SUBMITTALS

- A. Mechanical Shop Drawings, equipment cuts, and schedules shall be submitted to the Architect for review, in general before starting the work involved and so as to cause no delay in the Contractor's work or that of any other Contractor or Subcontractor. Number of copies as per the General or Supplementary Conditions of the Contract.
- B. All Shop Drawings, equipment cuts and schedules submitted shall bear the stamp of the Contractor, submitting same as evidence that they have been approved by the Contractor. Correction of dimensions, location of various items, encroachments of work of other Contractors or Subcontractors, or variations from the requirements of the Contract Documents shall be made or corrected by the Contractor.
- C. If the Shop Drawings show variations from the requirements of the Contract Documents because of standard shop practice or any other reason, the Contractor shall make specific mention of such variation in a transmittal letter.
- D. Where field measurements are required or necessary, they shall be made, when possible, before preparation of Shop Drawings and noted as such on Shop Drawings.
- E. The review of Shop Drawings, equipment cuts and schedules by the Architect will be general and shall be understood to mean that the Architect has no objection to use of materials or processes shown. The Architect's review shall not relieve the Contractor of responsibility for errors or omissions and deviations from the Contract requirements.
- F. SHOP DRAWINGS SHALL GENERALLY INCLUDE:
 - 1. Construction of the various parts, method of joinery, type of material, grade, quality and thickness of material, alloy of material, profiles of all sections, reinforcement, anchorage, type of finish and grade of finish, etc.

2. Capacities, types of materials and performance charts that are pertinent to the equipment item. Wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and specifications.

G. ELECTRONIC FORMAT:

1. Shop drawings may be submitted in electronic format utilizing PDF files. The submittal shall be organized by specification section and contain all required information within a PDF document for each specification section. The submittal shall be organized as follows:
 - a. Primary zip file contains a PDF of master transmittal cover page indicating the project name, submitting contractor, contact information and a list of all the sections with titles being submitted. This primary file shall also contain each of the individual PDF files for the individual sections being submitted.
 - b. Sub PDF file for each specification section organized as follows:
 - 1) First Page: Cover page indicating the project name, submitting contractor, contact information, space for Engineer's stamp.
 - 2) Page(s) for contractor qualifications and project certifications.
 - 3) Page(s) for Bill of Materials (BOM) list including part numbers, quantities and references to specification section paragraphs for each part.
 - 4) Page(s) for manufacturer's data sheets.
 - 5) Page(s)/Drawing(s) for system diagrams, riser diagrams, block diagrams, etc.
 - 6) Drawing(s) for floor plans showing equipment locations.

- H. See the individual equipment specification sections for any additional submittal requirements.

5.16 ACCESS PANELS

- A. Where valves, traps or other specialties are concealed in the construction or behind a wall or ceiling surface, the Contractor shall furnish and install an access panel of adequate size to permit adjustment or service of concealed device. Panels shall be of a design suitable for installation in the material forming the finished surface in which each is mounted. Panels shall be rated to maintain the fire barrier rating of wall or ceiling where installed. Approval of the Architect is required of all exposed access panels in finished areas.

- B. The Contractor shall confer with other Contractors and Subcontractors with respect to access panel locations and shall, wherever practicable, group valves, traps, dampers, etc. in such a way as to be accessible from a single panel and eliminate as many access panels as possible.
- C. Each access panel in masonry, plaster or drywall surfaces shall have a flush metal frame and flush hinged steel door with flush screwdriver-operated latch. Panels in acoustic ceiling shall be of recessed type, to which tile can be attached in such a manner that tile on panel will be flush with ceiling tile. Panels are not required where ceiling tiles are supported in exposed T-bar construction.

5.17 LOW-EMITTING MATERIALS

- A. Adhesives and sealants applied inside the building (weatherproofing system), shall comply with the following maximum limits for VOC content (in g/L less water) according to South Coast Air Quality Management District Rule #1168.
 - 1. Metal to Metal Adhesives: 30 g/L.
 - 2. PVC Welding: 510 g/L.
 - 3. CPVC Welding: 490 g/L.
 - 4. ABSC Welding: 325 g/L.
 - 5. Plastic Cement Welding: 250 g/L.
 - 6. Adhesive Primer for Plastic: 550 g/L.
 - 7. Other Sealants: 420 g/L.
 - 8. Other Sealant Primers: 750 g/L.
- B. Paint sealants applied inside the building (weatherproofing system), shall comply with the following maximum limits for VOC content (in g/L less water) according to South Coast Air Quality Management District Rule #1113.
 - 1. Waterproofing Sealers: 250 g/L.

5.18 SLEEVES

- A. Sleeves shall be installed by the Contractor wherever pipes pass through walls, slabs, floors or ceilings. No pipes shall pass through beams or be embedded in concrete. Sleeves in concrete shall be standard weight steel pipe or purchased units as specified below. Twenty-six (26) gauge galvanized steel sleeves are acceptable in wood, plaster or drywall partitions. All sleeves shall be sawed or machine cut (no flame cutting) and flush with finished surfaces except for mechanical equipment areas which shall extend 2 inches above finished floor and be of galvanized steel.
- B. Center pipe in sleeves with spacers.

- C. If possible, in new concrete work, sleeves shall be set into position before concrete is poured. Where pipe openings are required in concrete after the concrete has been poured, this Contractor shall core drill same and eliminate the pipe sleeve.
- D. Where pipes pass through exterior concrete walls, set Schedule 40 steel pipe or special manufactured castings or sleeves 1-1/2 inches larger than O.D. of pipe. Caulk both sides with oakum and lead wool, coat with bituminous paint and otherwise adequately waterproof opening around pipe. A casing seal system as manufactured by Thunderline Corporation under the trade name "Link-Seal" may be used instead of oakum and caulking. Contractor shall be aware of low VOC requirements mentioned in this section.
- E. Any plumbing piping that passes under a footing, through foundation wall or through a grade beam shall be provided with a Schedule 40 steel pipe sleeve built into footing, foundation wall or grade beam. Pipe sleeve shall be two pipe sizes greater than pipe passing through. Caulk both sides with oakum and lead wool, coat with bituminous paint and otherwise adequately waterproof opening around pipe. A casing seal system as manufactured by Thunderline Corporation under the trade name "Link-Seal" may be used instead of oakum and caulking. Contractor shall be aware of low VOC requirements mentioned in this section.
- F. Sleeves shall be installed by the Contractor whenever existing pipes pass through new walls erected for this project. Twenty-six (26) gauge galvanized steel split ring type sleeves are acceptable. Existing piping shown on the drawings is taken from record drawings and/or field observation and are deemed reliable only insofar as general layout is concerned. The responsibility for checking in place items will be the Contractor's.
- G. Openings around pipes or in sleeves for pipes passing through floor slabs, fire-rated walls or smoke barriers must be sealed with a non-combustible fire stop material. Seal at both sides of any cavity wall. Insulation shall not extend through sleeve. Fill sleeve opening with Dow Corning 3-6548 RTV silicone foam, 3M Fire Barrier, G.E. RTV or Flame Stop, Inc. Product shall intumesce (expand) when subjected to heat. When used for openings around PVC or similar pipe material, provide sufficient thickness of material around pipe to fill void completely if the pipe is consumed by the heat. An exterior metal holding collar and clamp may be required for this application. Depth of fill material shall provide same fire rating as floor or wall penetrated. Fiberglass is not acceptable, except as a backing for the above materials. Prepacked sleeves such as ProSet "Firestop Penetrators" as installed in accordance with the manufacturer's recommendations are acceptable. Contractor shall be aware of low VOC requirements mentioned in this section.
- H. Openings in sleeves for pipes passing through smoke partition shall be scaled on both sides of wall to prevent the passage of smoke.

- I. All metal piping passing through or adjacent to wood that has been treated with fire retardant chemicals shall be sleeved with Schedule 40 PVC piping one size larger than a bare metal pipe or one size larger than an insulated pipe. Alternate methods of protecting the piping may be used at the Contractor's option.

5.19 CORRELATION OF WORK AND INTERFERENCES

- A. Before installing any work, Contractor shall see that such installation will not interfere with clearances required for the proper finishing of Architectural Work including the finishing of surfaces. In general, all pipes in finished areas shall be installed and concealed in walls, furred spaces, pipe chases or above suspended ceilings. If an interference occurs, Contractor shall consult with the Architect before installing the pipe.
- B. Where work of the various Mechanical Contractors must be installed in confined spaces, the Superintendents of the Mechanical Contractors shall coordinate their work with the Superintendents of other pertinent trades before installation to assure against interferences. Failure to so coordinate such work shall place the responsibility for making any required changes in any trade upon the Contractor who shall have failed to join in the required cooperative effort, all at the direction of the Architect.

5.20 HOISTS, RIGGING, SCAFFOLDING AND TRANSPORTATION

- A. Contractor shall provide all required scaffolding, rigging, staging, tackle, hoists and similar devices and equipment necessary for proper installation of his work, shall remove all temporary materials of this nature when no longer required, and shall be responsible for the safe and lawful use thereof.
- B. Contractor shall be responsible for the transportation of all materials and equipment to the job site, adequate protected storage on site, and all costs of same.

5.21 PROVISIONS FOR LATER INSTALLATIONS

- A. Where work cannot be installed as the structure is being erected, Contractor for such work shall provide and arrange for the building-in of boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Contractor shall arrange for and lay out any chases, holes or other openings which must be provided in masonry, concrete or other work.
- B. Contractor shall be responsible for becoming informed of the nature and arrangement of the materials and construction to which this Contractor's work attaches, members with, or passes through.

5.22 OPERATING INSTRUCTIONS

- A. Contractor shall provide two (2) flash drives, each containing all operating, servicing, lubrication, etc. information and parts lists for all equipment installed under this Contractor's Contract. Material shall be grouped together by trades, each item marked with a tab, and an index shall be provided. Drives to be submitted for approval at least thirty (30) days before completion of the work.
- B. Flash Drives to Include
1. Step-by-step procedures for start-up and shut-down of each system and piece of equipment.
 2. Normal equipment operating characteristics.
 3. Performance data, curves, ratings.
 4. Wiring diagrams.
 5. Manufacturer's descriptive literature.
 6. Automatic controls with diagrams and written description of operation.
 7. Spare parts and replacement list for each piece of equipment.
 8. Name of service agency, installer and suppliers, and their telephone numbers.
 9. Final reviewed Shop Drawings.
 10. Balance report.
 11. Certificates of Tests and Approvals.
 12. Mechanical identification lists (Section 23 0553).
- C. Each flash drive shall also contain all temperature control diagrams applicable to the equipment.
- D. Contractor shall arrange for technical instruction of the Owner's Maintenance Personnel by qualified instructors for such time as is reasonably required to instruct them in the operation and maintenance of all mechanical systems. Instruction period shall be after all systems are in operation, and have been tested, balanced and adjusted. Contractor shall video all training sessions. Two (2) copies of video shall be included with closeout materials for future reference by the Owner.

5.23 EXCAVATION AND BACKFILL

- A. The Contractor shall do all excavating and backfilling in connection with this Contractor's work.
- B. Pipe trenches shall be cut to instrument grade, held to minimum width to accomplish the work, cut out for pipe hubs and fittings to obtain a solid bed for all buried work. In the event trenches are cut too deep, they shall be filled with sand to correct elevation and material shall be mechanically tamped to secure the foundation required. In event that unsuitable material for adequate pipe support is encountered, same shall be removed to sufficient depth and backfill installed to secure proper foundation.

- C. No piping shall be laid in water. Contractor shall provide and operate pumping equipment as may be necessary and shore trenches as may be necessary to prevent caving in of the work. Contractor installing the work shall be responsible for any damage to the work of other Contractors as a result of underground work.
- D. Backfill within building and under sidewalks and pavements shall be fine granular sand, to proper finished grade. Handfill and handtamp to not less than twelve inches (12") above piping in six inch (6") layers and complete backfill tamped in layers not to exceed six inches (6"). Backfill to meet compaction test as stated in Architectural Section of Specifications for backfill under slab.
- E. Backfill outside of building lines shall be tamped sand to twenty-four inches (24") above pipe as herein before described for interior work. Clean sand or clean earth, approved by Architect, to complete backfill tamped in layers not to exceed six inches (6"). Final six inches (6") of fill to establish grade shall be clean earth. Fill as necessary to allow for settling.
- F. When or if rock is encountered, the tamped sand bed below the pipe shall be a minimum of six inches (6"). Backfill shall be as specified in the above paragraphs. Explosives shall not be used for rock excavation.
- G. Excess excavated materials and debris shall be removed from the site by Contractor making the excavation.

END OF SECTION 22 0000

SECTION 22 0513 – COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Single Phase Electric Motors

1.02 RELATED SECTIONS

- A. Section 26 0533 – Raceways
- B. Section 26 2913 – Electrical Control Panels

1.03 REFERENCES

- A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Conform to NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide one (1) year manufacturer warranty for motors.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric
- B. Louis Allis
- C. Westinghouse
- D. General Electric
- E. Emerson Electric
- F. Substitutions: See General Requirements

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. The Electrical Contractor shall furnish all necessary disconnect switches, except on equipment, which is to be provided with disconnect switches as part of the assembly. The Electrical Contractor will furnish all power wiring through starters and disconnect switches to motors.
- B. Where electrical requirements and/or motor horsepower for the equipment supplied varies from that shown on the Plumbing Drawings or as specifically called out in the Plumbing Specifications, the Electrical Drawings and Specifications shall govern and be adhered to as to electrical power characteristics for the supplied equipment.
- C. Electrical Service:
 - 1. Refer to Section 26 0533 for required electrical characteristics.
 - 2. Motors Under 1/2 HP: 115 Volts, Single Phase, 60 Hz
- D. Construction:
 - 1. Design for continuous operation in 40 degrees C environment.
 - 2. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 22 0513

SECTION 22 0519 – GAUGES FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Thermometers and Thermometer Wells

1.02 RELATED SECTIONS

- A. Section 22 1113 – Facility Water Distribution Piping

1.03 REFERENCES

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers.
- B. ASTM E 1 - Standard Specification for ASTM Thermometers.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- C. Project Record Documents: Record actual locations of components and instrumentation.
- D. Operation and Maintenance Data.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 – PRODUCTS

2.01 STEM TYPE THERMOMETERS

- A. Manufacturers
 - 1. H. O. Trerice
 - 2. Weiss Instruments
 - 3. Weksler Glass Thermometer Corp.
 - 4. Ashcroft Pressure and Temperature Instruments
 - 5. Winters Instruments
 - 6. Marsh Instruments

- 7. Miljoco Corporation
- 8. Substitutions: See General Requirements
- B. Thermometer shall be H.O. Terrice #BX 91403 1/2 adjustable angle industrial thermometer with 9 inch scale, cast aluminum or molded glass reinforced polyester case, Model 3-4F2 size 3-1/2 inch brass separable socket (3/4 inch NPT).
- C. Thermometer shall be installed in a manner that insures that the bulb of the thermometer will be in a flow of fluid and yet not impair the flow of the fluid. Increase pipe size at this point if required.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- C. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- D. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- E. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION 22 0519

SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Valves
 - 1. Ball Valves
 - 2. Check Valves
 - 3. Plug valves

1.02 RELATED SECTIONS

- A. Section 22 0553 – Identification for Plumbing Piping and Equipment
- B. Section 22 0719 – Plumbing Piping Insulation
- C. Section 22 1116 – Domestic Water Piping
- D. Section 22 16 00 – Facilities Natural Gas Piping

1.03 REFERENCES

- A. ASME B 31.9 – Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).

1.04 SYSTEM DESCRIPTION

- A. This Contractor shall furnish all valves as indicated on the Drawings and as required for the proper control at various apparatus so that any apparatus may be removed for repair without interference to the remainder of the building.

1.05 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Include data on valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.06 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on valves. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 – PRODUCTS

2.01 SCHEDULE OF VALVES (PLUMBING)

GENERAL SERVICE	TYPE	MIN.VALVE RATING CWP (PSI) NON SHOCK	ENDS	BODY	TRIM	MANUFACTURER
Copper Piping 2" and Smaller (Good for 250° Service)	Check	200	Screwed	Bronze	Bronze	Nibco T-413-Y-LF
	Ball	600	Screwed	Bronze	Brass/S.S.	Nibco T-585-80-LF
	Ball	250	Press System	Bronze	Brass/S.S.	Nibco PC-585-80-LF
GENERAL SERVICE	TYPE	MIN.VALVE RATING SWP (PSI)	ENDS	BODY	TRIM	MANUFACTURER
Natural Gas 2" and Smaller	Ball	600	Screwed	Bronze	Teflon	Nibco T-585-70-UL
		600	Screwed	Bronze	Teflon	Nibco T-580-70-UL
	Plug	125	Screwed	Semi-Steel	-----	Nordstrom 142

2.02 VALVE NOTES

- A. Ball valve shall conform to the construction set forth in this schedule and shall be as manufactured by Nibco, Milwaukee, Smith, Crane, Apollo or Watts, Soldered joint ball valves in copper piping are not acceptable. Ball valve in insulated pipe line shall have 2 inch extension stem with handle.

- B. Other Valves: Check shall conform to the construction as set forth in this schedule and shall be as manufactured by Caleffi, Crane, Milwaukee, Nibco, Resun, or Nordstrom lubricated plug valves are acceptable.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Prepare valve connection to piping with flanges.
- B. Remove scale and dirt on inside and outside of valves prior to assembly.

3.02 INSTALLATION

- A. Install valves in accordance with manufacturer's instructions.
- B. Valves to be installed in an accessible location that allows for proper operation of the valve handle.
- C. Any valves installed in concealed spaces to have a proper access door for valve operation and maintenance.
- D. Use unions and couplings downstream of valves and at equipment or apparatus connections. Do not use direct threaded connections to valves, equipment or other apparatus.

END OF SECTION 22 0523

SECTION 22 0529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Hangers and Supports for:
 - 1. Plumbing Piping System
 - 2. Plumbing Equipment

1.02 RELATED SECTIONS

- A. Section 22 0719 – Plumbing Piping Insulation
- B. Section 22 1116 – Domestic Water Piping
- C. Section 22 1119 – Domestic Water Piping Specialties

1.03 REFERENCES

- A. ASME B31.9 – Building Services Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.9).

1.04 SYSTEM DESCRIPTION

- A. Contractor shall furnish and install all adjustable hangers, special pipe supports, spring hangers, anchors, clamps, rods, and appurtenances as required to securely, and properly hang, or support the piping systems. Hangers and supports shall be equivalent to the Anvil models specified.
- B. Contractor shall provide all miscellaneous steel and hardware as required to support, hang and secure all equipment, pipes, etc. as furnished by him, unless such materials are specifically called out to be provided by other Contractors.

1.05 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Include data on hangers and accessories. Provide manufacturers catalogue information. Indicate data and ratings.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Accept hanger material on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide proper storage.

1.09 EXTRA MATERIALS

- A. See General Requirements for additional provisions.

PART 2 – PRODUCTS

2.01 HANGERS

- A. Hangers not otherwise noted or specified shall be adjustable wrought iron clevis type, Anvil No. 260, for insulated and non-insulated steel pipe and insulated copper tubing. Bare copper tubing shall be supported with copper-plated plastic-coated hangers, Anvil Fig. CT-69. Suitable trapeze type hangers may be used where several lines are running parallel.
- B. Support all cast iron soil pipe horizontal runs, branch runs and at each change of direction with hanger equal to Anvil No. 260. Support vertical runs at each floor by means of a pipe clamp designed for that purpose. Base of each vertical run shall be supported with concrete or if above grade, with heavy duty hangers.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. All piping systems shall have anchorage, sway braces, guides and supports satisfactory to the Architect and shall be fabricated in accordance with ANSI Code B31.9, "Building Services Piping", latest issue, and must be installed with due regard for general requirements.

- B. Where hangers are supported from the building structural steel, they shall be attached to structural members by beam clamps bearing on both sides. Do not weld hanger rods to structural steel. When attaching to bar joists, attach at the panel points only. Attach to concrete decking using expansion bolts or concrete anchors. Anchors in overhead concrete deck and precast concrete panels shall meet ICC-ES AC193 (mechanical anchors) for both cracked and un-cracked concrete.
- C. At all hangers and supports of insulated pipe, provide oversized hangers to fit on the outside of the pipe saddles and shields. See insulation specification section for insulation thickness.
- D. For all insulated piping 4 inches and under, provide hangers on outside of insulated pipe (all sizes) with shields.
- E. Support cast iron soil pipe and fittings at sufficiently close intervals to maintain alignment and prevent sagging. Support each length of pipe with hanger located not more than 18 inches from the joint.
- F. Plumbing lines, etc. shall be independently supported from the building structure and shall not be supported from other ducts, pipes, etc. Where interferences do occur, provide trapeze type hangers or supports.

3.02 SCHEDULES

- A. Piping shall be supported with hangers spaced in accordance with the following schedules. Each section of pipe shall have at least one (1) hanger. Vertical lines shall be supported by pipe clamp type supports designed for this purpose at each floor level. On plastic piping which is insulated, reduce spacing to 70 percent of distances listed.

(1) <u>Steel Pipe</u>		(2) <u>Copper Tubing</u>		(3) <u>Rigid PVC Pipe</u> <u>(Up to 140°F)</u>	
<u>Pipe Size</u>	<u>Maximum Spacing</u>	<u>Pipe Size</u>	<u>Maximum Spacing</u>	<u>Pipe Size</u>	<u>Maximum Spacing</u>
Thru 1-1/4"	7'	Thru 3/4"	5'	Thru 1-1/4"	2-1/2'
1-1/2"	9'	1"	6'	1-1/2" & 2"	3'
2"	10'	1-1/4"	7'	2-1/2"	3-1/2'
		1-1/2"	8'	3"	3-1/2'

- B. Hanger and Rod Size Shall be as Follows:

<u>Pipe Size</u>	<u>Rod Size</u>
3/4 to 2 inch inclusive	3/8"

END OF SECTION 22 0529

SECTION 22 0553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Nameplates
- B. Tags
- C. Stencils
- D. Pipe Markers

1.02 RELATED SECTIONS

- A. Section 22 0523 – General Duty Valves for Plumbing Piping
- B. Section 22 1116 – Domestic Water Piping
- C. Section 22 1313 – Facility Sanitary Piping

1.03 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Samples: Submit two labels or tags.
- F. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- G. Project Record Documents: Record actual locations of tagged valves.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation
- B. Champion America, Inc.
- C. Seton Identification Products
- D. Substitutions: See General Requirements

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters
 - 1. Letter Color: White or Black
 - 2. Letter Height: 1/4 Inch or 1/2 Inch
 - 3. Background Color: Black, Red, Green or Yellow

2.03 VALVE TAGS

- A. Contractor shall provide a numbered brass tag, approximately 2 inch in diameter, chained to hand wheel of each valve, except local stop or shutoff valves to an item of equipment. Attach tag to valve with non-rusting "S" hook of adequate size. Each tag shall be stamped with a serial number and service designation of valve. Also indicate on tag whether the valve is normally-closed or normally-open in service (N.C. or N.O.).
- B. Numbers and locations shall be accurately marked on the "Record Drawings".
- C. Provide typed valve directions identifying each valve as to size, manufacturer, type, service and location. Copies shall be included in the Operating Instruction and Service Manual hereinafter specified.
- D. Verify numbering and tag designation system with Owner in order to be consistent with any existing identification system.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 Inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 - 2. Equipment: 2-1/2 inch high letters.
- B. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

- A. Color: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with paint manufacturer's recommendations for stencil painting.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with paint manufacturer's recommendations.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Identify valves in main and branch piping with tags.
- J. Each pipe, exposed or in an accessible space shall be identified as to service and direction of flow by stenciling with 1 inch high characters at each major change of direction, at 20 feet intervals in long straight runs, each branch connection, each riser, equipment connection, and both sides of a wall through which pipe passes. In architecturally finished areas, at the Architect's option, stenciling may be omitted.

- K. Each water heater, etc. shall be identified by stenciling the number assigned the unit on the Drawings with 1 inch high black characters.
- L. Provide one (1) coat of clear lacquer or varnish over the stencils.
- M. Manufactured labels are acceptable, providing they are properly attached to clean and dust-free surface to prevent curling or loosening.
- N. Verify nomenclature with Owner in order to be consistent with any existing identification system.

END OF SECTION 22 0553

SECTION 22 0719 – PLUMBING PIPING INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Pipe Insulation, Jacketing and Accessories
- B. Fixture Piping Insulation

1.02 REFERENCES

- A. ASHRAE Std 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings; 2007 (NOTE: Insulation thickness based on 2013)
- B. International Energy Conservation Code; 2009

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 22 0000 for low VOC submittal requirements.
- C. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation Instructions and Recommendations
 - 2. Installation Methods

PART 2 – PRODUCTS

2.01 MANUFACTURES

- A. Manufacturers
 - 1. Knauf Fiber Glass
 - 2. Johns Manville International, Inc.
 - 3. Owens Corning Corp.
 - 4. Armstrong Corp.
 - 5. Certainteed Corp.
 - 6. Substitutions: See General Requirements

2.02 PIPE INSULATION

- A. All insulation, unless otherwise noted, shall have a composite rating including insulation adhesives, jacket, etc. as follows. The composite assembly shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

- B. The piping insulation material shall be a UL-rated, noncombustible pipe insulation recommended for both hot and cold piping. Insulation shall be a heavy density sectional pipe insulation jacketed with an embossed vapor barrier laminated all-service jacket with self-sealing lap adhesive. Lap and seal all joints to insure vapor barrier. Thermal conductivity(k) shall not exceed 0.24 BTUH square foot F degree/inch. Insulation shall equal Owens-Corning Fiberglas 25 ASJ/SSL. Thickness as per tables in other sections of these Specifications. If staples are used on cold water lines, apply white vapor barrier mastic over staples.
- C. In lieu of the above, where allowable, for piping as listed below with up to 1 inch insulation, equivalent thickness 25/50 rated cellular plastic foam insulation (equivalent to AP Armaflex) may be used at Contractor's option. Insulation shall be applied in accordance with manufacturer's written instructions. On all outdoor installations apply two coats of finish equivalent to Armaflex white outdoor finish. At hangers, provide galvanized shield as previously specified.
 - 1. Domestic Hot and Cold Water
- D. Where fiberglass insulation on piping is used, pipe fittings shall be covered with insulating cement of a thickness equal to adjacent pipe insulation and wrapped with glass cloth.
- E. In lieu of building up a fitting with insulating cement, a preformed insulating fitting cover such as Zeston 25/50 rated PVC insulated fitting cover with fiberglass insert may be used.
- F. Only insulating materials meeting the 25/50 flame spread and smoke developed ratings are allowable in air ducts, air chases or air plenums.
- G. Any exposed insulated piping passing through a floor where it is subject to damage, shall be covered with a 0.016 inch (minimum) thick aluminum jacket 18 inches high.
- H. Insulate piping exposed to the weather with insulation as specified earlier except add one inch (1") additional thickness. Cover with a .016" thick smooth aluminum jacket with two inch (2") overlap at longitudinal and circumferential joints and secured in place with 1/2" x .020" stainless steel banding on eighteen inch (18") centers.

2.03 DAMAGED INSULATION

- A. All insulation damaged or removed due to work under this Contract shall be replaced with new insulation according to above specifications.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and applicable building codes.
- B. Locate seams in least visible location. Extend surface finishes to protect raw edges, ends and surfaces of insulation.
- C. Where vapor retarder facing or jacketing is specified, maintain continuous, unbroken moisture and vapor seal; insulate and vapor seal all hangers, supports, anchors, and other projections secured to cold surfaces to prevent condensation; repair penetrations and damage to vapor retarder using joint tape prior to system startup.
- D. Install pipe insulation continuously through walls, ceiling and floor openings, and sleeves except where firestopping materials are required.
- E. Insulation installed on piping operating below ambient temperature must have a continuous vapor retarder. Seal all joints, seams and fittings.
- F. Inserts and Shields
 - 1. Furnish and install at all hangers and supports of insulated pipe, 12" long sections of high density insulation that will not deflect more than 1/8" in an operating condition and covering at least 120 degree of the arc at the bottom of the pipe. On horizontal lines, provide 22 gauge galvanized sheet metal shields covering 50 percent of the circumference. On vertical lines, the sheet metal shields shall completely encircle the insulation. Maintain a full vapor barrier around the insulation as it passes through the shield. Pipe hanger, roller, or support shall be external at the shield. Contractor shall butt the adjacent insulation tightly to the insulation at the pipe shields and lap and seal all seams and joints. Special care shall be taken to insure that the vapor barrier at the pipe shields is not broken. Wood spacer between pipe and hanger is not allowed.

3.02 SCHEDULES

A. Service

	<u>Pipe Size</u>			
	<u>As Noted</u>	<u>1 1/4" & Below</u>		
Domestic Hot Water Above and Below Floor	----	1"		
Domestic Cold Water Above and Below Floor	----	1/2"		
Condensate Drain from A.C. Units	1/2"	----	----	----

All lavatories and sinks with exposed P-trap, hot and cold water angle stops and supplies shall be insulated with "TrueBro" Handi Lav-Guard insulation kit, Model #102W.

B. Fixture Piping Insulation

1. Manufacturers:

- a. Acceptable Manufacturer: Truebro, Inc.
- b. Substitutions: See General Requirements.

C. Piping Insulation Accessories

1. Provide products that comply with the following:

- a. Americans With Disabilities Act (ADA), Article 4.19.4.
- b. ANSI/ICC A117.1, American National Standard for Accessible Buildings and Facilities.
- c. BOCA Basic Building Code.
- d. Requirements of applicable building code.

2. Piping Safety Covers: Truebro Lav-Guard

- a. Characteristics: Three-piece molded assembly, minimum 1/8 inch (3 mm) wall thickness, with internal ribs to provide air space between piping and piping insulation jacket, molded to receive manufacturer's snap-clip fasteners.
- b. Vinyl Material: Impact-resistant and stain-resistant molded closed-cell anti-microbial vinyl compound, UV-stable, non-fading, non-yellowing; having the following performance characteristics:

- 1) Burning Characteristics: 0 seconds Average Time of Burning (ATB), 0 mm Area of Burning (AEB), when tested in accordance with ASTM D 635.
 - 2) Thermal Conductivity: K-value 1.17 (2.02), when tested in accordance with ASTM C 177.
 - 3) Indentation Hardness: 60, minimum, when tested in accordance with ASTM D 2240, using Type A durometer.
 - c. Trap Assembly Cover: Three-piece assembly, with removable clean-out nut enclosure.
 - d. Angle Stop Covers: Formed with hinged cap for access to valve without requiring cover removal.
 - e. Configurations: In accordance with manufacturer's product data for project piping configurations indicated on drawings.
 - f. Color: Light Gray or China White, gloss finish; paintable.
 - g. Fasteners: Manufacturer's standard re-usable snap-clip fasteners; wire-tie fasteners not permitted.
3. Lavatory Piping Enclosure: Truebro Lav-Shield
- a. Characteristics: One-piece rigid molded vinyl enclosure, minimum 1/8 inch wall thickness, factory-punched for manufacturer's wall fasteners.
 - b. Vinyl Material: Impact-resistant and stain-resistant molded closed-cell vinyl, having the following performance characteristics:
 - 1) Burning Characteristics: 0 seconds Average Time of Burning (ATB), 0 mm Area of Burning (AEB), when tested in accordance with ASTM D 635.
 - 2) Flammability: UL 94 V-O rating.
 - 3) Indentation Hardness: 69, minimum, when tested in accordance with ASTM D 2240, using Type A durometer.
 - c. Vinyl Color: China White, fine-textured finish; paintable.
 - d. Fasteners: Manufacturer's standard stainless steel wall fasteners with tamper-resistant heads.
4. Basin/Sink Piping Enclosure: Truebro Basin Guard
- a. Characteristics: One-piece rigid molded vinyl enclosure, minimum 0.093 inch wall thickness, factory-molded flanges for fasteners.
 - b. Vinyl Material: Impact-resistant and stain-resistant molded closed-cell vinyl, having the following performance characteristics:
 - 1) Burning Characteristics, when tested in accordance with ASTM D 635: 0 seconds Average Time of Burning (ATB), 0 mm Area of Burning (AEB).
 - 2) BOCA Basic Building Code Fire Rating: Class 1.

- 3) Indentation Hardness: 69, minimum, when tested in accordance with ASTM D 2240, using Type A durometer.
- c. Width: 36 inches.
- d. Color: Beige or White, fine-textured finish; paintable.
- e. Fasteners: Supply non-corroding fasteners with tamper-resistant heads; type recommended by manufacturer for indicated project conditions.

END OF SECTION 22 0719

SECTION 22 1116 – DOMESTIC WATER PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Pipe, Pipe Fittings, and Connections for Piping Systems
 - 1. Domestic Water Service Meter and Setting
 - 2. Cold and Hot Water Piping to Fixtures and Equipment Including Final Connection.

1.02 RELATED SECTIONS

- A. Section 22 0000 – Basic Plumbing Requirements
- B. Section 22 0523 – General Duty Valves for Plumbing Piping
- C. Section 22 0529 – Hangers and Supports for Plumbing Piping and Equipment
- D. Section 22 0553 – Identification for Plumbing Piping and Equipment
- E. Section 22 0719 – Plumbing Piping Insulation

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 22 0000 for low VOC submittal requirements.
- C. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.
- D. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

- A. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of Ohio plumbing code.
- B. The domestic water service shall comply in all respects to the Local City, Division of Water, Engineering Specifications and Local Plumbing Codes.

- C. The domestic service shall be installed as shown on drawing after the drawings are approved by the authority having jurisdiction.
- D. Piping at the city water meter setting per local water department regulations.
- E. All new domestic water service piping and valves to be AWWA stamped and approved.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED EXTERIOR OF BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Domestic Water	Exterior of Building Underground				
	3" and Smaller	Soft Copper Tube	Brazed (No Joints if Possible)	Pressure Fittings	

2.02 WATER PIPING, BURIED UNDER FLOOR WITHIN BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Domestic Water	Inside Building Under Floor 3" and Smaller (Less than 100 psi)	Type "K" Soft Copper Tube ASTM B88-83a	Brazed (No Joints if Possible)	Wrought Standard Weight Pressure Rated	

2.03 DOMESTIC WATER PIPING, ABOVE GRADE, INSIDE BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Domestic Water	Inside Building Above Floor 3" and Smaller (Less than 100 psi)	Type "L" Copper Hard Temper	Soldered Or Press Connected	Wrought Standard Weight Pressure Rated	

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inch and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions. Galvanized
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 3 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.
- G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Architect.
- H. Establish elevations of buried piping outside the building to ensure not less than five ft of cover.
- I. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- L. Install bell and spigot pipe with bell end upstream.
- M. Install valves with stems upright or horizontal, not inverted.
- N. Sleeve pipes passing through partitions, walls and floors.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 ERECTION TOLERANCES

- A. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 CLEAN AND DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. During construction pipe openings shall be plugged to minimize dirt accumulation in the lines.

3.07 INSPECTION

A. Inspect Water Distribution Piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
2. During progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to time inspection must be made. Perform tests specified below in presence of the plumbing official.
3. Roughing-in Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.
4. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
5. Reinspections: When a plumbing official finds that piping system will not pass test or inspection, make required corrections and arrange for reinspection by the plumbing official.
6. Reports: Prepare inspection reports signed by plumbing official.

3.08 TESTING

A. Test Water Distribution Piping as follows:

1. Test for leaks and defects in new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
2. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.
3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.09 CLEANING

A. Clean and Disinfect Water Distribution Piping as follows:

1. Purge new potable water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired prior to use.
2. Use purging and disinfection procedure prescribed by authority having jurisdiction or, if a method is not prescribed by that authority, the procedure described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill system or part thereof with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) and allow to stand for 24 hours.
 - c. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine. Isolate and allow to stand for 3 hours.
 - d. Flush system with clean, potable water until chlorine does not remain in water coming from system following allowed standing time.
 - e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by the authority shows evidence of contamination.

B. Prepare and submit reports for purging and disinfecting activities and deliver to Owner.

3.10 COMMISSIONING

A. Fill water systems. Check compression tanks to determine that they are not air bound and that system is completely full of water.

B. Before operating systems, perform these steps:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to full open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housing and verify that cartridges are as specified for application where used, clean, and read for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

- D. Check plumbing specialties and verify proper settings, adjustments, and operation.
- E. Energize pumps and verify proper operation.
- F. Provide new water service complete with approved reduced pressure backflow preventer and or double check backflow preventer and water meter with by-pass valves.
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
 - 2. Provide 18 gauge galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

END OF SECTION 22 1116

SECTION 22 1119 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Hydrants
- B. Backflow Preventers
- C. Mixing Valves at Water Heaters
- D. Water Outlet Box and Valves

1.02 RELATED SECTIONS

- A. Section 22 1116 – Domestic Water Piping
- B. Section 22 4000 – Plumbing Fixtures

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Project Record Documents: Record actual locations of equipment, backflow preventers, and water hammer arrestors.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.06 EXTRA MATERIALS

- A. See General Requirements for additional provisions.
- B. Supply for Owner's use in maintenance of project:
 - 1. Two loose keys for outside hose bibbs
 - 2. Two hose end vacuum breakers for hose bibbs

PART 2 – PRODUCTS

2.01 HYDRANTS

- A. Manufacturers
 - 1. Chicago Faucet
 - 2. Jay R. Smith Manufacturing Company
 - 3. Zurn Industries, Inc.
 - 4. T & S Brass
 - 5. Woodford
 - 6. Substitutions: See General Requirements
- B. Wall Hydrants (WH)
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome plated or polished bronze wall plate or lockable recessed box hose thread spout, handwheel or lockshield and removable key, and integral vacuum breaker. Equal to Woodford 65

2.02 BACKFLOW PREVENTERS

- A. Manufacturers
 - 1. Conbraco Industries
 - 2. Febco
 - 3. Zurn/Wilkins, Ind. Inc.
 - 4. Watts Regulator Company
 - 5. Substitutions: See General Requirements
- B. Backflow prevention device shall be tested and certified under latest ASSE Standard #1013, USCFCC Manual, AWWA Standard C506 and be approved by EPA, local and state codes.
- C. (1/2 inch thru 2 inches) Reduced pressure principle back flow prevention device shall include shutoff valves, test cocks and full size drain with air gap connection device. Watts #LF009-S.

2.03 MIXING VALVES AT WATER HEATERS

A. Manufacturers

1. Powers
2. Leonard
3. Bradley
4. Armstrong-Rada
5. Caleffi
6. Lawler

2.04 WATER OUTLET BOXES AND VALVES

A. Box Manufacturers

1. IPS Corporation/Water-Tite
2. Oatey
3. Sioux Chief
4. Substitutions: See General Requirements

B. Valve Manufacturers

1. IPS Corporation/Water-Tite
2. Oatey
3. Sioux Chief
4. Substitutions: See General Requirements

C. Water Outlet Box

1. Water outlet connection box with 3/8" ¼ turn valve. Equal to IPS Guy Gray MDWB4AB.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on, janitor rooms, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- C. Pipe relief from backflow preventer to nearest drain.
- D. Trap primer piping shall pitch towards drain trap a minimum of 1/8" per foot.

END OF SECTION 22 1119

SECTION 22 1313 – FACILITY SANITARY PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Pipe, Pipe Fittings, and Connections for Sanitary Piping Systems:

1. Sanitary

1.02 RELATED SECTIONS

- A. Section 22 0000 – Basic Plumbing Requirements
- B. Section 22 0529 – Hangers and Supports for Plumbing Piping and Equipment
- C. Section 22 0553 – Plumbing Identification
- D. Section 22 0716 – Plumbing Equipment Insulation
- E. Section 22 0719 – Plumbing Insulation

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 22 0000 for low VOC submittal requirements.
- C. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.
- D. Project Record Documents.

1.04 QUALITY ASSURANCE

- A. All pipes and fittings shall have the manufacturer's identifying mark stenciled, stamped or rolled onto the surface in accordance with latest ASTM Specifications. "All cast iron pipes and fittings shall have the collective trademark of the Cast Iron Soil Pipe Institute."

1.05 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with the State of Ohio plumbing code.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.01 SANITARY SEWER PIPING, UNDERGROUND EXTERIOR OF BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Sanitary Waste	Exterior of Building Underground	PVC ASTM D-3034 SDR 35, Maximum Pipe Length 12'-6"	ASTM D-3212 Push-on Gasket Rubber Sealing Ring-tight, or Solvent	Push-on Bell & Spigot	----

2.02 SANITARY PIPING, UNDERGROUND WITHIN BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Sanitary Waste	Inside Building Underground 10" and Smaller	Asphalt-coated, Service Weight Cast Iron CISPI 301 + ASTM A-888	No-Hub "Clamp-All" Model #125, Husky 4000 or "Mission" Heavy Weight ASTM C-1540	Asphalt-coated Service Weight Cast Iron	----
		PVC Schedule 40 DWV ASTM D-2665 & ASTM D-2321	Solvent Weld	Socket	

2.03 SANITARY PIPING, ABOVE GRADE INSIDE BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Sanitary Waste and Vent	Inside Building Aboveground	Asphalt-coated Service Weight Cast Iron CISPI 301 + ASTM A-888	Slip Joint ASTM C564-70 or No-Hub "Clamp-All" Model #125, "Husky" 4000 or "Mission" Heavy Weight ASTM C-1540	Asphalt-coated, Service Weight Cast Iron	
		Schedule 40 ASTM A-53 Galvanized Steel	Screwed	Black Cast Iron Recessed Drainage Type	
		PVC Schedule 40 DWV ASTM D-2665 & ASTM D-2321	Solvent Weld	Socket	

2.04 CONDENSATE DRAIN AND RELIEF VALVE DISCHARGE

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS
Condensate Drain and Relief Valve Discharge	Inside Building Above Floor	Copper Type "L" Hard Tempered	Soldered or Press Fit	Wrought Copper

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.

- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Establish elevations of buried piping outside the building to ensure not less than three feet of cover.
- F. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- G. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- H. Install bell and spigot pipe with bell end upstream.
- I. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.
- J. Sleeve pipes passing through partitions, walls and floors.
- K. Inserts
 - 1. Support cast iron drainage piping at every joint.
- L. Install cast-iron soil pipe and cast-iron soil pipe fittings according to CISPAs latest revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- M. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- N. Place plugs in ends of uncompleted piping at end of day or when work stops.
- O. Slope sanitary waste lines 1/8 inch per foot for all lines 3 inches and over and 1/4 inch for all lines 2-1/2 inches and under unless noted otherwise on Drawings.

- P. Make directional changes with T-Y fittings or Y fittings and 1/8 bends as required. Install cleanouts at each directional change greater than 45 degrees, at the base of each riser, at 50 foot intervals on 4 inch horizontal straight runs at, 100 foot intervals on 6 inches horizontal straight runs, at dead ends, on all exposed or accessible traps and all other locations indicated on the Drawings or as required to remove obstructions.
- Q. Sanitary vents shall terminate no less than 12 inches and shall be not less than 3 inches in diameter. Plumbing vents shall be offset in roof joist space, if necessary, so that vent extensions through roof are not less than 4' from exterior building walls and exceed the allowable minimum distance to outside air intakes of roof mounted equipment.
- R. Install test tees at the base of each stack and elsewhere as required for sectionalized testing of the system.
- S. CPVC and PVC piping is not allowed in supply or return air plenum.
- T. Flashing for vent pipe through membrane roof shall be by Roofing Contractor.

3.04 PREPARATION OF FOUNDATION FOR BURIED PIPING

- A. The Contractor shall do all excavating and backfilling in connection with his work.
- B. Grade trench bottom to provide smooth, firm stable, and rock-free foundation throughout length of piping.
- C. Remove unstable, soft, and unsuitable materials at surface on which piping is to be laid and backfill with clean sand or pea gravel to indicated level.
- D. Shape bottom of trench to fit bottom of piping. Fill unevenness with tamped-sand backfill. Dig bell holes at each pipe joint to relieve bells of loads and to ensure continuous bearing of pipe barrel on foundation.
- E. Pipe trenches shall be cut to instrument grade, held to minimum width to accomplish the work, cut out for pipe hubs and fittings to obtain a solid bed for all buried work. In the event trenches are cut too deep, they shall be filled with sand to correct elevation and material shall be mechanically tamped to secure the foundation required. In event that unsuitable material for adequate pipe support is encountered, same shall be removed to sufficient depth and backfill installed to secure proper foundation.
- F. No piping shall be laid in water. Contractor shall provide and operate pumping equipment as may be necessary and shore trenches as may be necessary to prevent caving in of the work. Contractor installing the work shall be responsible for any damage to the work of other Contractors as a result of underground work.

- G. Backfill within building shall be fine granular sand, to proper finished grade. Handfill and handtamp to not less than twelve inches (12") above piping in six inch (6") layers and complete backfill tamped in layers not to exceed six inches (6"). Backfill to meet compaction test as stated in Architectural Section of Specifications for backfill under slab.
- H. When or if rock is encountered, the tamped sand bed below the pipe shall be a minimum of six inches (6"). Backfill shall be as specified in the above paragraphs. Explosives shall not be used for rock excavation.
- I. Excess excavated materials and debris shall be removed from the site by Contractor making the excavation.
- J. For underground piping exterior to the facility, provide Seton underground warning tapes, buried above the pipe line at approximately 18" to 24" below grade. Tape to be 2" wide, brightly colored, and shall indicate service of buried pipe. For non-metallic pipe, use metallic lined tape.

3.05 INSPECTION

A. Inspect Drainage Piping as follows:

- 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
- 2. During progress of installation, notify the plumbing official having jurisdiction prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.
- 3. Roughing-in Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.
- 4. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
- 5. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
- 6. Reports: Prepare inspection reports signed by the plumbing official.

3.06 TESTING

A. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:

- 1. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.
3. Test piping of plumbing drainage and venting systems on completion of rough-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack opening on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1 inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.07 CLEANING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.

3.08 COMMISSIONING

- A. Check plumbing equipment and verify proper settings, adjustments and operation.
- B. Check plumbing specialties and verify proper settings, adjustments, and operation.
- C. Energize pumps and verify proper operation

3.09 ERECTION TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot or 1/8 inch per foot slope.

3.10 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION 22 1313

SECTION 22 1319 – SANITARY WASTE PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Floor Drains
- B. Cleanouts

1.02 RELATED SECTIONS

- A. Section 22 1313 – Facility Sanitary Piping
- B. Section 22 4000 – Plumbing Fixtures

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Project Record Documents: Record actual locations of equipment, cleanouts.
- F. Operation Data: Indicate frequency of treatment required for interceptors.
- G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.06 EXTRA MATERIALS

- A. See General Requirements for additional provisions.

PART 2 – PRODUCTS

2.01 DRAINS

A. Manufacturers

1. Josam Company
2. Jay R. Smith Manufacturing Company
3. Zurn Industries, Inc.
4. Mifab
5. Wade
6. Substitutions: See General Requirements

B. Floor Drain (FD-1)

1. Dura-coated cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, round adjustable nickel-bronze strainer. Equal to Zurn ZN-415-6B. Provide with ASSE 1072 compliant barrier-type trap seal protection device manufactured by Zurn, RectorSeal, Jay R. Smith, IPS Corp. and Green Drain.

2.02 CLEANOUTS

A. Manufacturers

1. Jay R. Smith Manufacturing Company
2. Josam Company
3. Zurn Industries, Inc.
4. Mifab
5. Wade
6. Substitutions: See General Requirements

B. CO

1. Cleanout plug for cast iron hub & spigot shall be screwed brass.
2. Cleanout plug for cast iron no hub shall be a blind plug.
3. Cleanout plug for PVC shall be a cleanout adapter with cleanout plug.

C. FCO

1. Finished floor cleanout, Zurn ZN-1400-T, with cast iron body and adjustable nickel bronze top.
2. Floor cleanout for carpeted area, Zurn ZN-1400-T-CM, with cast iron body, adjustable nickel bronze top and carpet marker.

4. Floor cleanout for PVC or glass piping; Zurn ZP-1404 with ABS body and nickel bronze top.

D. COTG

1. Exterior cleanout, Zurn Z-1406-HD-VP, heavy duty with vandalproof screwed top.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.

END OF SECTION 22 1319

SECTION 22 1600 – FACILITIES NATURAL GAS PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Pipe, Pipe Fittings, and Connections for Piping Systems:
 - 1. Gas

1.02 RELATED SECTIONS

- A. Section 22 0000 – Basic Plumbing Requirements
- B. Section 22 0523 – General Duty Valves for Plumbing Piping
- C. Section 22 0529 – Hangers and Supports for Plumbing Piping and Equipment

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 22 0000 for low VOC submittal requirements.
- C. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.
- D. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
- B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of Ohio plumbing code.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 – PRODUCTS

2.01 NATURAL GAS PIPING, BURIED EXTERIOR OF BUILDING

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Natural Gas	Exterior of Building Underground	Schedule 40 Black Steel ASTM A-53 Coated and Wrapped X- Tru-Coat	Butt Welded	Standard Weight Welded Coated and Wrapped	None Underground
		Polyethylene ASTM D-2513	Heat Fusion Approval by Gas Utility	ASTM D- 2513 and D-2683	None

Plastic underground service pipe with copper tracing strip acceptable if approved by gas utility.

Steel pipe to be provided with approved material to retard corrosion and cathodically protected with magnesium anodes.

2.02 NATURAL GAS PIPING ABOVE GRADE

SERVICE	CONDITIONS	MATERIALS	JOINT	FITTINGS	FLANGES OR UNIONS
Natural Gas	Inside Building Aboveground 2" and Smaller (Less than 5 psig)	Schedule 40 Black Steel ASTM A-53	Screwed	150# Black Malleable Iron	300 # Black Malleable Iron Ground Joint

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. General

1. The use of plastic pipe for service lines is limited to customer service lines designed to operate at 60 psig or less. Installation of plastic piping above grade is prohibited except for that plastic which may terminate above ground in an approved riser.
2. At all times, the plastic material shall be protected from fire and excessive heat. While in storage, the plastic pipe shall be adequately supported and protected from long-term exposure to direct sunlight. Plastic pipe which has been exposed to direct sunlight for a long period will discolor and show craze marks indicating product deterioration, and shall not be used.
3. The age of plastic pipe can be determined from the marking on the pipe wall. Plastic pipe that is older than 24 months shall not be installed. All plastic pipe manufacturers incorporate the date the pipe was made in the product code on the pipe. Plumbers should familiarize themselves with these codes so that they can make certain the pipe is acceptable.
4. Plastic piping shall be installed in such a way that shear or tensile stresses resulting from construction, backfill, thermal contraction and external loading are minimized. The piping shall be laid on undisturbed or well compacted soil. The piping shall not be supported by blocking. Plastic pipe shall be installed with sufficient slack to provide for possible thermal contraction. Cooling may be necessary before the last connection is made, under extremely high temperature conditions.
5. Install in accordance with manufacturer's instructions.
6. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
7. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
8. Install piping to maintain headroom, conserve space, and not interfere with use of space.
9. Group piping whenever practical at common elevations.
10. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
11. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.
12. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Architect and other Contractors.
13. Establish elevations of buried piping outside the building to ensure not less than 18 inches of cover.
14. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

15. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
16. Provide support for utility meters in accordance with requirements of utility companies.
17. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
18. Install valves with stems upright or horizontal, not inverted.
19. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
20. Sleeve pipes passing through partitions, walls and floors.

B. Trenching

1. A plastic customer service line shall be laid on undisturbed or well compacted soil in a separate trench or in a joint trench with other utility services, maintaining a minimum separation of 12 inches horizontally. It shall not be run through septic tanks and leaching beds.
2. The trench shall be graded uniformly to provide solid and continuous foundation for the pipe. There shall be at least 6 inches of clearance where it is necessary for other utility services to cross either over or under the service line.
3. Plastic service lines shall be laid at sufficient depth to provide a minimum of 18" cover over the pipe.

C. Joining Pipe

1. It is preferable to install the plastic service line as one continuous length of pipe between the curb valve or fitting at the property line and the riser or joint of connection to coated steel pipe at the building. Where it is necessary to use more than one length of plastic pipe in the customer service line, the lengths shall be joined by either an approved compression type coupling or heat-fusion joint. When a compression fitting is used it must be installed according to the manufacturer's instructions. All underground metallic fittings shall be coated and cathodically protected.
2. Persons making plastic pipe joints must be qualified to make that type of joint. The Gas Company Representative can supply information on obtaining qualification and the procedures to follow on the job.
3. The procedure and equipment recommended by the manufacturer of the approved plastic pipe for making heat-fusion joints shall be used. Socket fused plastic fittings may be used on approved sizes up to, but not including, 2 inches. When fusing sizes 2 inches and larger, only butt fusions are permitted.
4. Direct application of heat with a torch or other open flame to the plastic pipe is prohibited.

D. Bends

1. Changes in direction of plastic piping may be made with bends or elbows under the following limitations:

The minimum bending radii are as follows:

<u>Size</u>	<u>125 x D*</u>	<u>25 x D**</u>
1" CTS	12.0'	2.5'
1-1/4" IPS	18.0'	3.5'
2" IPS	25.0'	5.0'

* 125 x D (outside diameter) for service lines containing fusion joints (butt, socket and saddle) or mechanical fittings with the bend radius.

** 25 x D (outside diameter) for service lines without fusion joints or mechanical fittings within the bend radius.

2. The bends shall be free of buckles, cracks, or other evidence of damage.
3. Changes in direction that cannot be made in accordance with (1.) above shall be made with elbow-type fittings.

E. Tracer Wire

1. A TW insulated #14 minimum size copper wire shall be installed with all non-cased plastic service lines to serve as a means to locate and trace the plastic pipe when using pipe locators. The most effective method of tracing the insulated wire is with the pipe locator in the "conductive" mode of operation.
2. Insulated tracer wire shall be accessible so a connection can be made to the pipe locator transmitter. Therefore, bring the tracer wire up along the outside of the curb or valve box to prevent interference. Do not connect the tracer wire to steel pipe.

F. Backfilling

1. Backfilling shall be performed in a manner to provide firm support around the piping. The material used for backfilling shall be free of large rocks, building materials, etc., that might cause damage to the plastic pipe.
2. Small excavated rocks may be returned to the trench, but shall be prevented from contacting the pipe by earth padding of not less than 6" above the pipe.
3. No heavy equipment shall be run over the customer service line or trench immediately after it has been backfilled.
4. Where flooding of trench is done to consolidate the backfill, care shall be taken to see that the plastic pipe is not floated from its firm bearing on the bottom of the trench.

G. Inspection and Testing

1. The Contractor shall give the Gas Company notice that work is completed and ready for testing. This notice must be made to the Gas Company at least 24-hours in advance of the time when desired.

2. A new service line shall be visually inspected before the trench is filled. Any excavation(s) made during either plastic insert renewal work or installation of piping by the "plow-in" method shall not be backfilled until after the installation has been visually inspected by the Gas Company. A new plastic service line installed by direct burial may be backfilled for protection with approval of the Gas Company. The end connections and any fittings used to join lengths of pipe must remain exposed for inspection by the Gas Company.
3. A new customer service line shall be given a pressure test after construction and before being placed in service to demonstrate that it is gastight.
4. Air or an inert gas such as nitrogen shall be used to pressurize the piping. In no case shall oxygen, acetylene, Freon or other such gases be used.
5. To locate leaks, piping joints should be covered with soapsuds or a leak-finder liquid. In no case shall ether (as an odorant), Freon, or any gas that will produce a toxic atmosphere when burned, be injected in the piping to locate leaks.
6. Pressure Test Requirements: Service lines to operate at a pressure of 60 psig or less shall be given a pressure test at 90 psig, for at least ten minutes with no drop in pressure.
 - a. A soap suds test shall be made at operating pressure of all exposed fittings in the service line which were not included in the pressure drop test.
 - b. For service lines to operate at pressures above 60 psig, consult the Gas Company.
7. In the event the lines will not pass the first inspection and test, or if other unsatisfactory conditions result in the disapproval by the Gas Company, the necessary correction shall be made at the Contractor's expense and the line involved shall again be inspected and tested.
8. The results of the service line test will be recorded by the Gas Company Representative on an appropriate form.

H. Coatings

1. Mill Supplied Pipe Coatings:
 - a. Republic Steel Corporation "X-Tru-Coat", Minnesota Mining and Manufacturing Company "Skotchote 202", Cook Paint and Varnish Company "SD Pipeclad II".
2. Tape Coatings:
 - a. Shuller Corporation "Duratape", Tapecoat Company "Tapecoat Special", Protector Wrap Company, "Protecto Wrap No. 110", Royston Labs "Rosko Quick Wrap".

I. Cathodic Protection

1. Protect metallic pipe from corrosion by installation of anodes. This is in addition to and supplementary to protective coatings.
2. Size, composition and installation of anodes shall be per Gas Company standards.

J. Anode Installation

- | | | |
|----|----------------------|-----------------------------|
| 1. | <u>Pipe Size</u> | <u>Anode Weight</u> |
| | 2 Inches and Smaller | 1-5 Lb. Anode per 100 Feet |
| | 3 Inches and Larger | 1-17 Lb. Anode per 100 Feet |
2. Bury 2 feet below pipe and 4 feet from riser to outdoor meter setting or 4 feet from service entrance. Additional anodes for piping over 100 feet in length shall be spaced at middle distance of added footage.
 3. Anode Lead Attachment: Clean pipe to dry parent metal. Attach lead to pipe by thermit weld process using a maximum charge of 15 grams. Clean weld of slag and dirt, repair pipe coating as specified herein.

3.04 METER SETTING AND ENTRANCE PIPING

A. General

1. The Gas Company will furnish and connect a meter for each customer, and this meter shall remain the property of the Gas Company.
2. The Gas Company will have available prefabricated meter set assemblies for outside domestic meter installations, where applicable.
3. When service is provided from distribution mains at pressure in excess of one psig, the Gas Company will furnish the service regulator(s) necessary to reduce the pressure. The service regulator(s) shall remain the property of the Gas Company.

B. Location

1. The Gas Company reserves the right to determine the location of the meter set assembly.
2. The meter set assembly shall be located as near as practical to the point where the service line enters the building. It shall be so installed as to allow for ready access to the meter(s) for examination, reading and replacement.
3. All piping from the point where the service line enters the building to the location of the meter set assembly shall be exposed and accessible.
4. The meter set assembly shall not be installed in a small, unventilated, or confined space.
5. The meter set assembly shall not be placed where it will be exposed to damage such as in driveways, parking lots, public passages, halls, coal bins, etc., or where it will be subjected to excessive corrosion, or under fire escapes.

Where deemed necessary by the Gas Company, the customer will be required to provide suitable protection for the meter setting. The type of protection to be used shall be under the direction of the Gas Company.

6. The meter set assembly shall be located at a minimum distance of three feet from any electrical panel or meter, furnace or incinerator and a furnace or incinerator vent connector. Locations at which there are either extreme temperatures or sudden changes in temperatures should be avoided.
7. Service regulators shall be installed outside of the building where practical and be located at a place where gas from the vent can escape freely into the atmosphere and away from any opening into the building.

C. Riser

1. An approved flexible steel casing or rigid non-corrosive steel encased plastic service line riser shall be used with plastic service lines. A wall mounting plate or bracket fastened to the riser and building wall shall be used to firm the installation. Where it is not practical to attach the wall bracket to the building wall, a heavy gauge steel stake firmly embedded parallel and immediately adjacent to the foundation wall shall be used as a support.
2. The riser shall be installed in such a position that the completed meter set assembly will allow a minimum of 6 inches clearance between the bottom of the meter and the finished grade.
3. Where a riser passes through a walk, patio or driveway, it shall be installed through a sleeve or other means of providing a space between the riser and the walk, patio or driveway. The space between the sleeve and the riser shall be filled with gravel.

D. Meter Valves

1. Meter valves approved by the Gas Company shall be used. Valves, nominal pipe sizes $\frac{3}{4}$ inch, 1 inch and 1-1/4 inches, shall be of the insulating union type having lockwing head or equivalent and tamperproof core. These meter valves shall be provided with a drilled and tapped 1/8 inch port on the inlet side of the valve body for test purposes. An Allen head plug shall be used to close the port.
2. Where the inlet piping to a single meter set assembly is 2 inch nominal pipe size, an insulating union, flange or coupling shall be installed in the setting aboveground and downstream of the meter valve to electrically isolate the service line from the house lines. In addition, a test tee shall be installed aboveground upstream of the meter valve.

E. Installation

1. Distance between meter and any wall shall be minimum of 6 inches. On outside meter settings, the bottom of the meter shall be a minimum of 6 inches above finished grade.

2. Meter set assemblies shall be plumb and level so that the meter will line up properly with the meter connections.

3.05 PIPING IN PLENUM OR CONCEALED

- A. No piping shall be installed in a solid partition.
- B. Piping shall not be installed in or through a circulating air duct, clothes chute, chimney, flue, ventilating duct, dumb waiter or elevator shaft.
- C. Gas piping may be installed in accessible above ceiling space, whether or not such space is used as an air plenum. Valves shall not be located in such space.
- D. Concealed piping shall be joined by welding. Concealed gas piping is that, which when in place in a finished building would require removal of permanent construction to gain access to the piping. The number of joints shall be kept to a minimum. Valves, unions, tubing fittings and swing joints shall not be installed in concealed space.
- E. Regulators
 1. Self-contained, non-pulsating, pressure reducing valve with a Buna-N valve disc, replaceable without removing valve body, cast iron standard globe body, nylon fabric reinforced Buna-N vented diaphragm. Valve shall be suitable for natural gas at 0.60 specific gravity, operate in the middle $\frac{3}{4}$ of its range and have a minimum inlet pressure rating of 60 psi. (A.W. Cash Company, Fisher Controls, Masoneilan, Pyponics, Inc.)
 2. Valves at Regulators: An accessible gas shutoff valve shall be provided upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve shall not be required at the second regulator.
 3. An independent vent to the outside of the building, sized in accordance with the regulator manufacturer's instructions, shall be provided where the location of a regulator is such that a ruptured diaphragm will cause a hazard. Where there is more than one regulator at a location, each regulator shall have a separate vent to the outside, or if approved by the authority having jurisdiction, the vent lines may be manifolded but sized to minimize back pressure in the event of diaphragm failure.
- F. Drips and Sediment Traps
 1. Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
 2. Construction drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

G. Testing

1. All work installed under this Contract shall be tested in the presence of and to the satisfaction of the Gas Utility and the Owner's Representative.
2. The Contractor is responsible to provide all necessary tees, valves, gauges, piping connections, pump, etc. as required to perform tests.
3. When Contractor is ready for testing, the gas utility shall be notified no less than 24-hours in advance.
4. Test Preparation:

- a. Pipe joints, including welds, shall be left exposed for examination during the test.
- b. Equipment that is not to be included in the test shall be either disconnected from the piping or isolated by blanks, blind flanges, or caps.
- c. Prior to testing, the interior of the pipe shall be cleared of all foreign material.

5. Test Pressure:

- a. Test pressure shall be measured with a manometer or with a pressure measuring device designed and calibrated to read, record or indicate a pressure loss due to leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made.
- b. The test pressure to be used shall be no less than 1-1/2 times the proposed maximum working pressure, but not less than 3 psig, irrespective of design pressure.

6. Detection of Leaks and Defects:

- a. The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gages shall be deemed to indicate the presence of a leak unless such reduction can be readily attributed to some other cause.
- b. The leakage shall be located by means of an approved combustible gas detector, soap and water, or an equivalent nonflammable solution. Matches, candles, open flames, or other methods that could provide a source of ignition shall not be used.
 - 1) CAUTION: Since some leak test solutions, including soap and water, may cause corrosion or stress cracking, the piping shall be rinsed with water after testing, unless it has been determined the leak test solution is noncorrosive.
 - 2) Where leakage or other defects are located, the affected portion of the piping system shall be repaired or replaced and retested at Contractor's expense.

- 3) If a leak in existing gas system is evident during testing for new system, the cost to determine the location and for the repair of the leak will be additional to the Base Contract. Contractor to secure Owner approval before commencing this work.

7. Test Records:

- a. Records shall be made of inspection and all tests performed.

8. System and Equipment Leakage Test:

- a. Before Turning Gas On: Before gas is introduced into a system of new gas piping, or back into an existing system after being shut off, the entire system shall be inspected to determine that there are no open fittings or ends and that all manual valves at outlets on equipment are closed and all unused valves at outlets are closed and plugged or capped.
- b. Test for Leakage: Immediately after turning on the gas, the piping system shall be tested to ascertain that no gas is escaping. If leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.

3.06 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Provide valves in natural gas systems for shut-off service.

END OF SECTION 22 1600

SECTION 22 3300 – ELECTRIC DOMESTIC WATER HEATERS

PART 1- GENERAL

1.01 SECTION INCLUDES

- A. Residential Electric Water Heaters
- B. Diaphragm Type Expansion Tanks

1.02 RELATED SECTIONS

- A. Section 26 0533 – Raceways

1.03 SUBMITTALS

- A. See General Requirements for submittals procedures.
- B. Product Data
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Provide electrical characteristics and connection requirements.
- C. Shop Drawings
 - 1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 CERTIFICATIONS

- A. Water Heaters: NSF approved
- B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453

- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide three (3) year manufacturer warranty for domestic water heaters.

PART 2 – PRODUCTS

2.01 WATER HEATER MANUFACTURERS

- A. A.O. Smith Water Products Co.
- B. Lochinvar Corporation
- C. State Industries
- D. Bradford White Corporation
- E. PVI Industries, Inc.
- F. Substitutions: See General Requirements.

2.02 RESIDENTIAL ELECTRIC WATER HEATERS

- A. Type: Automatic, electric, vertical storage
- B. Performance
 - 1. Storage capacity: 10 gal.
 - 2. Heating element size: 1.5 kW
 - 3. Number of heating elements: 1
 - 4. Minimum recovery rate: 6 gph with 100 degrees F temperature rise
 - 5. Maximum working pressure: 150 psig
- C. Electrical Characteristics
 - 1. 120 volts, single phase
 - 2. 12.5 amperes maximum fuse size
- D. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.

- E. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
- F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve.

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers
 - 1. Amtrol Inc.
 - 2. ITT Bell & Gossett
 - 3. Taco, Inc.
 - 4. Substitutions: See General Requirements
- B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.
- C. Domestic Water Storage Tanks
 - 1. Provide steel pipe support, independent of building structural framing members.
 - 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

END OF SECTION 22 3300

SECTION 22 4000 – PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Water Closets
- B. Lavatories
- C. Sinks
- D. Electric Water Coolers
- E. Janitor (Mop) Sinks

1.02 RELATED SECTIONS

- A. Section 22 0716 – Plumbing Equipment Insulation
- B. Section 22 1119 – Domestic Water Piping Specialties

1.03 REFERENCES

- A. ARI 1010 – Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.
- B. ASME A112.18.1 – Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.
- C. ASME A112.19.2 – Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2003.
- D. ASME A112.19.3 – Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2000 (R2004).
- E. ASME A112.19.5 – Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.

- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

1.09 EXTRA MATERIALS

- A. See General Requirements for additional provisions.
- B. Supply two sets of faucet washers.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers listed may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance. Burden of proof for equality of plumbing fixtures is on the proposer.

- B. Manufacturers: Subject to compliance with requirements, provide products in each category, by one of the following listed for that category:
1. Water Closets:
 - a. Kohler
 - b. American Standard
 - c. Zurn
 2. Lavatories:
 - a. Kohler
 - b. American Standard
 - c. Zurn
 4. Electric Water Coolers:
 - a. Oasis
 - b. Elkay
 - c. Halsey Taylor
 - d. Haws
 5. Utility Sinks:
 - a. Fiat Products
 - b. Mustee
 - c. Zurn
 6. Sinks:
 - a. Elkay
 - b. Just
 - c. Moen
 7. Toilet Seats:
 - a. Olsonite
 - b. Church
 - c. Beneke
 - d. Sperzel
 8. Carriers or Supports:
 - a. Zurn
 - b. Josam
 - c. Smith
 - d. Mifab
 - e. Wade

9. Faucets:
 - a. Chicago
 - b. Kohler
 - c. American Standard
 - d. Speakman
 - e. Delta
 - f. Moen
 - g. Elkay
 - h. Zurn
 - i. T&S Brass
10. Miscellaneous Trim (Traps, Supplies, Strainers):
 - a. Dearborn Brass
 - b. Brass Craft
 - c. Chicago
 - d. Kohler
 - e. American Standard
 - f. McGuire
 - g. Royal Brass
 - h. T & S Brass
 - i. Zurn
11. Drain and Supplies Insulation Kits:
 - a. True-Bro
 - b. Skal-Gard
 - c. PlumberEX
 - d. ProFlo
 - e. Dearborn Safety Series

2.02 FIXTURE DESIGNATIONS

A. Water Closet, WC-1: Kohler K-3978 (Floor Set, Tank Type)

1. Material: Vitreous China
2. Color: White
3. Bowl Type and Operation: Elongated, Siphon Jet
4. Mounting and Outlet: Floor Mounted, Floor Outlet
5. Fixture Bolt Caps: White, Plastic
6. Rim Height: 14-1/2 inches
7. Design Water Consumption: 1.6 Gallons per flush
8. Trap Passageway: 2 1/8" minimum
9. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-DL-C 1/2" x 3/8" supply stop and riser

- b. Toilet Seat: Olsonite 95-SSCT, commercial, heavy duty solid plastic, elongated, open front without cover, self-sustaining check hinges

B. Water Closet, WC-2: Kohler K-3979 (ADA, Floor Set, Tank Type)

1. Material: Vitreous China
2. Color: White
3. Bowl Type and Operation: Elongated, Siphon Jet with trip lever on the left side of the tank.
4. Mounting and Outlet: Floor Mounted, Floor Outlet
5. Fixture Bolt Caps: White, Plastic
6. Rim Height: 16-1/2 inches for ADA
7. Design Water Consumption: 1.6 Gallons per flush
8. Trap Passageway: 2 1/8 " minimum
9. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-DL-C, 1/2" x 3/8" supply stop and riser
 - b. Toilet Seat: Olsonite 95-SSCT, commercial, heavy duty solid plastic, elongated, open front without cover, self-sustaining check hinges

C. Lavatory, LV-1: Kohler K-2032

1. Material: Vitreous China
2. Lavatory Type: Wall Hung, 4" Faucet Centers
3. Dimensions: 20" x 18"
4. Color: White
5. Fittings and Accessories: Provide the following compatible components:
 - a. Faucet: Kohler K-15199-4NDRA (Single Lever Type) (0.5 gpm)
 - b. Supplies: Brass Craft SCR-1912-AC (1/2" x 3/8" angle stop, compression type, loose-key)
 - c. Drain: Kohler K-7129-A (perforated grid strainer and tailpiece)
 - d. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
 - e. Carrier: Zurn Z-1231
 - f. Drain and Supplies Insulation Kit: True Bro Model #102W
 - g. Temperature Control Valve (ASSE 1070): Powers Hydroguard LFe480

D. Water Cooler, EWC-1: Oasis PG8EBFSL (Split-Level)

1. Water Cooler Types: Wall Hung, Two Front Touch Pads with bottle filler.
2. Capacity: 8.0 GPH cooled to 50° with air ambient temperature of 90°F.
3. Cabinet Material: Vinyl Covered Heavy-Gauge Steel
4. Color or Finish: Sandstone, Vinyl
5. Mounting: Wall Hanging

6. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-AC
 - b. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
 - c. Carrier: Zurn Z-1225-BL

E. Janitor (Mop) Sink, MS-1: Fiat Model MSB-2424

1. Material: Molded Stone
2. Dimensions: 24" x 24" x 10"
3. Fittings and Accessories: Provide the following compatible components:
 - a. Faucet: Chicago 540-LD897-SWXF204CP
 - b. Strainer: Provided with unit
 - c. Rim Guard: Fiat E-77-AA
 - d. Hose and Bracket: Fiat 832-AA
 - e. Mop Rack: Fiat 889-CC
 - f. Trap: 3" P-Trap
 - g. Sealant: Fiat 833-AA
 - h. Check Valves: Provide on CW and HW supply lines to faucet

F. Sink, SK-1: Elkay LR-2219

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Single Bowl with 3 Faucet Holes
4. Dimensions: 22" x 19-1/2" x 7-1/2"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Garbage disposer: In-Sink-Erator Evolution Excel
8. Fittings and Accessories: Provide the following compatible components:
 - a. Faucet: Elkay LKD-2442 (Kitchen Style)
 - b. Supplies: Brass Craft OCR-1912-AC
 - c. Strainer: Elkay LK-35
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify roughing-in for potable cold water, hot water supplies, waste and vent piping systems to verify actual locations of piping, prior to installing.

3.02 PREPARATION

- A. Install carriers and hangers for wall-mounted fixtures in walls before wall surface is complete.

3.03 INSTALLATION

- A. Install fixtures and fitting in accordance with manufacturer's instruction.
- B. Install fixtures plumb and level.
- C. Install fixtures at height designated on architectural drawings.
- D. Set floor sinks in leveling bed of cement grout.
- E. Install removable key stop valve in an accessible location in each water supply to fixture.
- F. Install trap on fixture outlet except for the fixtures have integral trap.
- G. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
- H. Seal fixtures to walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant with sealant color to match fixture color.

3.04 TESTING, ADJUSTING AND CLEANING

- A. Test fixtures to demonstrate proper operation upon completion of Installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- B. Operate and adjust faucets and controls. Replace damaged and malfunctioning faucets, fittings and controls.
- C. Replace washers of leaking and dripping faucets and stops.
- D. Adjust water pressure, electric water coolers and faucets having controls, to provide proper flow and stream.
- E. Clean fixtures, fittings, spout, and drain strainers with manufacturer's recommended cleaning methods and materials.

END OF SECTION 22 4000

DIVISION 23 – MECHANICAL
TABLE OF CONTENTS

<u>SECTION #</u>	<u>SECTION TITLE</u>	<u># PAGES</u>
<u>HVAC</u>		
23 0000	Basic Heating, Ventilation & Air Conditioning (HVAC) Requirements	13
23 0513	Common Motor/Electrical Requirements for HVAC Equipment.....	3
23 0529	Hangers and Supports for HVAC Piping and Equipment	3
23 0593	Testing, Adjusting and Balancing for HVAC.....	7
23 0713	Duct Insulation.....	3
23 2300	Refrigerant Piping.....	4
23 3113	Metal Ducts and Duct Liner	7
23 3313	Dampers.....	5
23 3423	HVAC Power Ventilators	3
23 3713	Diffusers, Registers and Grilles	4
23 3723	HVAC Exterior Intakes and Relief / Exhaust Outlets.....	3
23 5400	Forced Air Furnaces.....	5
23 8126	Split System Air Conditioners/Heat Pump.....	4

SECTION 23 0000 – BASIC HEATING, VENTILATION & AIR CONDITIONING (HVAC)
REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 1 – General Requirements are part of this Section as if written in full herein. Contractor is held to have familiarized himself with these provisions contained therein.

PART 2 – SCOPE OF WORK

2.01 GENERAL

- A. The work included by these Specifications is intended to include the furnishing of all labor, materials and equipment required for, or reasonably incidental to, the complete installation of the heating, ventilating and air conditioning system as hereinafter specified and as indicated on the Drawings. The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. Unless otherwise specifically stipulated, the term "Furnish and Install Complete" shall be considered a part of each Section.
- B. In general, the work shall include but not be limited to the following items:
 - 1. Furnaces, coils and condensing units.
 - 2. Exhaust fans.
 - 3. Ductwork, diffusers and associate duct accessories.
 - 4. Ductless split air condition system
 - 5. Permits, inspections, tests and fees related to this work.
 - 6. Insulation.
 - 7. Housekeeping pads and bases.
 - 8. All interlock wiring.
 - 9. Submittals.
 - 10. Instruction of Owner's Personnel and operating manuals.
 - 11. Warranty.

PART 3 – EXECUTION

3.01 PERMITS AND INSPECTIONS

- A. Contractor shall secure all required permits, shall pay for all inspections required by controlling authorities, and shall pay all charges in connection with his work.

3.02 SITE VISITATION

- A. It is strongly recommended that all Bidders visit and examine the site.
- B. No additional compensation will be awarded for deviations or discrepancies. Contractor shall become familiar with all conditions under which work must be performed, and shall check all present elevations.
- C. The Contractor shall report any major discrepancies to the Architect. Failure to report such discrepancies shall be deemed acceptance of existing conditions.

3.03 ORDINANCES AND CODES

- A. All work shall be installed in accordance with the local regulations and State Codes and shall receive the approval of the inspection department having jurisdiction. The Drawings and Specifications constitute the minimum acceptable requirements.
- B. Should any work shown on the Drawings or herein specified be contrary to said minimum requirements, ordinances, statutes or regulations, the work shall be executed in accordance with the requirements, ordinances, statutes or regulations, but not until the points in question have been referred to the Architect for approval.
- C. All tests shall be made as required by above mentioned requirements, ordinances, statutes or regulations, or by the inspector having jurisdiction. The cost of such tests shall be included in the Contract Price and evidence of such tests and inspections shall be provided for the Owner's files.

3.04 WARRANTY

- A. The Contractor shall warrant his workmanship and materials for a period of one (1) year from the date of final acceptance by the Architect or beneficial use by the Owner, whichever occurs first. The work shall be left in perfect order at completion and should defects develop within the warranty period, the Contractor shall, upon notice of same, remedy the defects and reimburse the Owner for all damage to the other work, whether caused by the defects or the work of correcting same.
- B. By mutual agreement, the Owner may occupy or use a portion or portions of the work prior to total project completion. Acceptance of any work by the Architect shall be accomplished by the issuance of a Certificate of Substantial Completion, a copy of which shall be promptly sent to the Contractor. From the date of issuance of such certificate, the Contractor shall be relieved of his obligation to maintain the portion of the premises accepted, but shall remain obligated to correct any "punch list" items uncorrected. The Contractor shall also continue to be responsible for all latent defects covered by the warranty described above, and shall continue to carry insurance to protect both the Owner and the Contractor's firm for workmen engaged on contingency items.

- C. Contractor should note that portions of this project may be used for temporary heating and plumbing and this shall not void or shorten the warranty period. Maintenance of equipment during construction shall be the responsibility of each Mechanical Contractor. All warranties, whether equipment, materials, etc., if used during construction or not, shall be under a warranty period of one (1) year after final acceptance of the project or beneficial use by the Owner, whichever occurs first. Any such defects noted during the warranty period shall be promptly rectified by the Contractor without expense and with a minimum of inconvenience to the Owner.
- D. The Contractor shall guarantee free and unrestricted flow of air and fluids without objectionable noise, and shall further guarantee all ducts, pipes and specialties to remain free from objectionable and/or substantial leaks during the warranty period.
- E. By entering into or accepting this Contract, the Contractor guarantees proper operation in accordance with the true intent of these Drawings and Specifications. If the Contractor is not satisfied that the requirements will make the guarantee possible, the Contractor shall submit with the bid a brief statement of such changes desired to have made therein which will enable the Contractor to give the guarantee.
- F. Certificates of approved final inspections by the authorities having jurisdiction shall be available for the Owner.

3.05 COMPLETION AND ACCEPTANCE

- A. When the Contractor is satisfied that all work required by Drawings and Specifications for the Contractor's division of the Contract has been completed, notification shall be given to the Architect that this is substantially correct. The Contractor will be notified immediately as to acceptance or rejection of the notification.
- B. Upon acceptance of this notification, the Owner's Representative will conduct a final observation of the work (punch list) to determine what items remain in an unacceptable condition. A report of this observation will be delivered to the Contractor as soon as possible following acceptance of the Contractor's letter of completion.
- C. Upon receipt of the final punch list items, the Contractor shall take immediate corrective action on all items. When all items on the list have been corrected to the satisfaction of the Architect, the final "Contract Completion Certificate" shall be executed. See General Conditions of these Specifications.

3.06 DRAWINGS

- A. In general, Drawings are schematic in nature, are intended as a guide to the Contractor, and do not necessarily show all details, offsets, etc. All Drawings are to be thoroughly inspected. For construction purposes, Drawings should not be scaled.
- B. The Contractor's work shall conform to the information contained in this Specification and/or as indicated in the latest revision to the Drawings referred to therein. The Contractor shall consult with the Architect regarding all questions which may be in doubt before proceeding with fabrication of parts affected. The Contractor shall prepare all additional detail or field installation drawings necessary at the Contractor's own expense. The Contractor shall verify all dimensions and conditions indicated on the layout Drawings and determine if any changes are required in piping runs, drains, ducts, etc. to avoid interference. Major changes shall not be made without the approval of the Architect.
- C. While the Drawings are to be adhered to as closely as possible, the Contractor has the right to vary the run of piping and/or ducts during progress of the work as may be found necessary or desirable to avoid interferences. Major revisions shall be verified with the Architect.
- D. In general, the Specifications are written in the singular form. The Drawings should be used to determine the number of items required for a complete installation.

3.07 VERIFICATION

- A. Before running any ducts, piping, etc. within the building, this Contractor shall assure that they can be installed as contemplated without trapping or interfering with columns, beams, piping, fixtures, etc. Contractor to verify all measurements and conditions at job site before proceeding with the work. Any necessary major deviation shall be referred to the Architect for adjustment before lines are run, at no increase in contract price.
- B. Of necessity, openings, supporting steel, field-built curbs, electrical data, space requirements, etc. were designed around specific parameters. When the Contractor determines the make of equipment to be provided for the job, it shall be the Contractor's responsibility to verify and coordinate unit dimensions with the General Contractor and all other interested Contractors on the job. It shall also become the Contractor's responsibility to change as necessary, through the Architect, all required dimensions so that openings, supporting steel, curbs, electrical data, etc. will fit the equipment supplied. Any additional cost will be the sole responsibility of this Contractor.

- C. In addition, electrical power, interlock and control diagrams and piping arrangements were designed around one specific manufacturer. If additional wiring, piping, controls, etc. are required for other equipment, this Contractor shall include the cost of same in his price.
- D. Dimensions, elevations and relative locations of existing equipment, sewers, pipes, ducts, etc. in place as shown on the Drawings, are taken from record drawings and/or field observation and are deemed reliable only insofar as general layout is concerned. Such dimensions shall not be used for layout drawings nor detailing of components. The responsibility for checking in place items will be the Contractor's. All measurements, the exact determination of relative elevations or locations, the ascertaining of accuracy of all given elevations and dimensions and the obtaining of all necessary additional information to insure the proper fit and coordination of all equipment, ducts, and piping shall be the responsibility of the Contractor.

3.08 WORKMANSHIP AND LAYOUT

- A. All work shall be done by mechanics skilled in the particular trade involved, under responsible supervision, and with the best modern practices.
- B. Contractor shall consult all drawings, construction details and job site and confer and cooperate with other Contractors and the Owner to avoid interferences.
- C. All materials shall be new and of the grade and quality specified. Only the best material of each class specified shall be used.
- D. The General Contractor will provide duct openings and pipe shaft openings in the new construction where shown on the architectural or structural drawings and also where indicated and sized by this Contractor. Openings required due to untimely or inaccurate layout by the Mechanical Contractor shall be at the Mechanical Contractor's own expense using skilled workmen and the proper tools for the work involved.

3.09 CUTTING AND PATCHING

- A. All cutting and patching of, or repair of damage to work in place or in existing construction shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Mechanical Contractor whose operations require cutting of work in place or existing construction, or who causes damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay all costs of such cutting or repair. All patching required to match existing adjacent construction shall be by the General Contractor at the Mechanical Contractor's expense.
- B. No structural members shall be cut without the approval of the Architect and any such cutting shall be done in a manner directed by the Architect.

3.10 PROTECTION

- A. The Contractor shall provide approved protection for all work included in this Contract and be responsible for damage of any kind to fixtures, piping or other work. At the completion of the project, the Contractor shall remove all protection and replace all damaged work without expense to the Owner.
- B. In addition to the normal precautions for protection of work, Contractor shall provide various types of protection as follows:
 - 1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and an oil proof floor cover.
 - 2. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
 - 3. Protect equipment and finished surfaces from paint droppings, insulation adhesive and sizing droppings, etc. by use of drop cloths.
- C. All pumps, motors, fans and other rotating equipment shall be stored at the site with openings, bearings, etc. covered to exclude dust and moisture. All stock piled pipe shall be placed on dunnage and protected from weather and from entry of foreign material.
- D. During construction, open ends of ducts, pipes, equipment, etc. shall be capped or plugged to reduce dirt accumulation inside.

3.11 MANUFACTURER'S DIRECTIONS

- A. Manufacturer's directions shall be followed in all cases where the manufacturer of articles used in this Contract furnish directions covering specific points for the installation, startup, operation or maintenance of these articles. Directions in conflict with the Drawings or the Specifications shall be referred to the Architect for clarification.

3.12 RECORD DRAWINGS

- A. Contractor shall keep an accurate record of all deviations from Contract Drawings. The Contractor shall neatly and correctly enter, in colored pencil, any deviations on Drawings affected during the progress of the project and shall keep Drawings available for inspection.
- B. At completion of job and before final acceptance, make any final corrections to Drawings and deliver same to the Architect.

3.13 CLEAN-UP

- A. Contractor shall frequently clean up all refuse, rubbish, scrap materials and debris caused by the Contractor's operations to the end that at all times the site shall present a neat, orderly and workmanlike appearance. Crates and cartons in which materials, equipment or fixtures are received shall be removed daily.
- B. If, in the opinion of the Architect, neatness is not maintained, the Architect may have the area cleaned as defined in the General Conditions.
- C. Contractor, at the completion of the work, shall remove all surplus material, false work, temporary structures, including foundations thereof and debris of every nature resulting from their operations and put the site in a neat and orderly condition.
- D. In addition to ordinary precautions in keeping ducts, pipes and equipment clean and free of debris during construction, the Contractor shall make provisions for cleaning out ducts and pipes making use of the greatest velocities available. The Contractor shall provide attendance, temporary connections and filters as required.
- E. The exterior of ducts, pipes and equipment shall be cleaned of all dirt and grease, preparatory to insulation or painting.

3.14 TESTING AND ADJUSTMENT

- A. All work installed under this contract shall be tested in the presence of and to the satisfaction of the inspecting authority having jurisdiction and the Architect.
- B. All ductwork, piping or equipment not found tight under test shall be reworked or replaced, as directed.
- C. Contractor shall operate all parts of the entire system, make any and all adjustments and repairs, and shall leave the entire work tested and ready for operation by the Owner and/or operation and final testing and balancing by the Testing and Balancing Subcontractor.
- D. If the installed equipment does not meet the specified capacities (cfm, heat output, cooling output, etc.) or if the motor operating current exceeds the nameplate ratings, such equipment shall be corrected by the Contractor.

3.15 SUBMITTALS

- A. Mechanical Shop Drawings, equipment cuts, and schedules shall be submitted to the Architect for review, in general before starting the work involved and so as to cause no delay in the Contractor's work or that of any other Contractor or Subcontractor. Number of copies as per the General or Supplementary Conditions of the Contract.

- B. All Shop Drawings, equipment cuts and schedules submitted shall bear the stamp of the Contractor, submitting same as evidence that they have been approved by the Contractor. Correction of dimensions, location of various items, encroachments of work of other Contractors or Subcontractors, or variations from the requirements of the Contract Documents shall be made or corrected by the Contractor.
- C. If the Shop Drawings show variations from the requirements of the Contract Documents because of standard shop practice or any other reason, the Contractor shall make specific mention of such variation in a transmittal letter.
- D. Where field measurements are required or necessary, they shall be made, when possible, before preparation of Shop Drawings and noted as such on Shop Drawings.
- E. The review of Shop Drawings, equipment cuts and schedules by the Architect will be general and shall be understood to mean that the Architect has no objection to use of materials or processes shown. The Architect's review shall not relieve the Contractor of responsibility for errors or omissions and deviations from the Contract requirements.
- F. SHOP DRAWINGS SHALL GENERALLY INCLUDE:
 - 1. Construction of the various parts, method of joinery, type of material, grade, quality and thickness of material, alloy of material, profiles of all sections, reinforcement, anchorage, type of finish and grade of finish, etc.
 - 2. Capacities, types of materials and performance charts that are pertinent to the equipment item. Wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and specifications.
- G. ELECTRONIC FORMAT:
 - 1. Shop drawings may be submitted in electronic format utilizing PDF files. The submittal shall be organized by specification section and contain all required information within a PDF document for each specification section. The submittal shall be organized as follows:
 - a. Primary zip file contains a PDF of master transmittal cover page indicating the project name, submitting contractor, contact information and a list of all the sections with titles being submitted. This primary file shall also contain each of the individual PDF files for the individual sections being submitted.
 - b. Sub PDF file for each specification section organized as follows:
 - 1) First Page: Cover page indicating the project name, submitting contractor, contact information, space for Engineer's stamp.

- 2) Page(s) for contractor qualifications and project certifications.
- 3) Page(s) for Bill of Materials (BOM) list including part numbers, quantities and references to specification section paragraphs for each part.
- 4) Page(s) for manufacturer's data sheets.
- 5) Page(s)/Drawing(s) for system diagrams, riser diagrams, block diagrams, etc.
- 6) Drawing(s) for floor plans showing equipment locations.

- H. See the individual equipment specification sections for any additional submittal requirements.

3.16 LUBRICATION AND PACKING

- A. All rotating and reciprocating equipment requiring lubrication shall be lubricated with the correct grade, type and quality of lubricant before being placed in service.
- B. Maintain all lubrication gaskets and packing during construction and assure that at the time of acceptance by the Owner, all are in first class operating condition.
- C. All lubrication fittings shall be extended as required for accessibility.

3.17 ACCESS PANELS

- A. Where valves, traps, dampers or other specialties are concealed in the construction or behind a wall or ceiling surface, the Contractor shall furnish and install an access panel of adequate size to permit adjustment or service of concealed device. Panels shall be of a design suitable for installation in the material forming the finished surface in which each is mounted. Panels shall be rated to maintain the fire barrier rating of wall or ceiling where installed. Approval of the Architect is required of all exposed access panels in finished areas.
- B. The Contractor shall confer with other Contractors and Subcontractors with respect to access panel locations and shall, wherever practicable, group valves, traps, dampers, etc. in such a way as to be accessible from a single panel and eliminate as many access panels as possible.
- C. Each access panel in masonry, plaster or drywall surfaces shall have a flush metal frame and flush hinged steel door with flush screwdriver-operated latch. Panels in acoustic ceiling shall be of recessed type, to which tile can be attached in such a manner that tile on panel will be flush with ceiling tile. Panels are not required where ceiling tiles are supported in exposed T-bar construction.

3.18 LOW-EMITTING MATERIALS

- A. Adhesives and sealants applied inside the building (weatherproofing system), shall comply with the following maximum limits for VOC content (in g/L less water) according to South Coast Air Quality Management District Rule #1168.
 - 1. Metal to Metal Adhesives: 30 g/L.
 - 2. PVC Welding: 510 g/L.
 - 3. CPVC Welding: 490 g/L.
 - 4. ABSC Welding: 325 g/L.
 - 5. Plastic Cement Welding: 250 g/L.
 - 6. Adhesive Primer for Plastic: 550 g/L.
 - 7. Other Sealants: 420 g/L.
 - 8. Other Sealant Primers: 750 g/L.
- B. Paint sealants applied inside the building (weatherproofing system), shall comply with the following maximum limits for VOC content (in g/L less water) according to South Coast Air Quality Management District Rule #1113.
 - 1. Waterproofing Sealers: 250 g/L.

3.19 SLEEVES

- A. Sleeves shall be installed by the Contractor wherever pipes pass through walls, slabs, floors or ceilings. No pipes shall pass through beams or be embedded in concrete. Sleeves in concrete shall be standard weight steel pipe or purchased units as specified below. Twenty-six (26) gauge galvanized steel sleeves are acceptable in wood, plaster or drywall partitions. All sleeves shall be sawed or machine cut (no flame cutting) and flush with finished surfaces except for mechanical equipment areas which shall extend 2 inches above finished floor and be of galvanized steel.
- B. Center pipe in sleeves with spacers.
- C. If possible, in new concrete work, sleeves shall be set into position before concrete is poured. Where pipe openings are required in concrete after the concrete has been poured, this Contractor shall core drill same and eliminate the pipe sleeve. Note: In mechanical equipment areas, provide a 2" high dam around core drilled opening sealed to the floor to prevent water leakage to the space below.
- D. Where pipes pass through exterior concrete walls, set Schedule 40 steel pipe or special manufactured castings or sleeves 1-1/2 inches larger than O.D. of pipe. Caulk both sides with oakum and lead wool, coat with bituminous paint and otherwise adequately waterproof opening around pipe. A casing seal system as manufactured by Thunderline Corporation under the trade name "Link-Seal" may be used instead of oakum and caulking. Contractor shall be aware of low VOC requirements mentioned in this section.

- E. Any piping that passes under a footing, through foundation wall or through a grade beam shall be provided with a Schedule 40 steel pipe sleeve built into footing, foundation wall or grade beam. Pipe sleeve shall be two pipe sizes greater than pipe passing through. Caulk both sides with oakum and lead wool, coat with bituminous paint and otherwise adequately waterproof opening around pipe. A casing seal system as manufactured by Thunderline Corporation under the trade name "Link-Seal" may be used instead of oakum and caulking. Contractor shall be aware of low VOC requirements mentioned in this section.
- F. Sleeves shall be installed by the Contractor whenever existing pipes pass through new walls erected for this project. Twenty-six (26) gauge galvanized steel split ring type sleeves are acceptable. Existing piping shown on the drawings is taken from record drawings and/or field observation and are deemed reliable only insofar as general layout is concerned. The responsibility for checking in place items will be the Contractor's.
- G. Openings around pipes or in sleeves for pipes passing through floor slabs, fire-rated walls or smoke barriers must be sealed with a non-combustible fire stop material. Seal at both sides of any cavity wall. Insulation shall not extend through sleeve. Fill sleeve opening with Dow Corning 3-6548 RTV silicone foam, 3M Fire Barrier, G.E. RTV or Flame Stop, Inc. Product shall intumesce (expand) when subjected to heat. When used for openings around PVC or similar pipe material, provide sufficient thickness of material around pipe to fill void completely if the pipe is consumed by the heat. An exterior metal holding collar and clamp may be required for this application. Depth of fill material shall provide same fire rating as floor or wall penetrated. Fiberglass is not acceptable, except as a backing for the above materials. Prepacked sleeves such as ProSet "Firestop Penetrators" as installed in accordance with the manufacturer's recommendations are acceptable. Contractor shall be aware of low VOC requirements mentioned in this section.
- H. All metal piping passing through or adjacent to wood that has been treated with fire retardant chemicals shall be sleeved with Schedule 40 PVC piping one size larger than a bare metal pipe or one size larger than an insulated pipe. Alternate methods of protecting the piping may be used at the Contractor's option.

3.20 CORRELATION OF WORK AND INTERFERENCES

- A. Before installing any work, Contractor shall see that such installation will not interfere with clearances required for the proper finishing of Architectural Work including the finishing of surfaces. In general, all ductwork and pipes in finished areas shall be installed and concealed in walls, furred spaces, pipe chases or above suspended ceilings. If an interference occurs, Contractor shall consult with the Architect before installing the duct or pipe.

- B. Where work of the various Mechanical Contractors must be installed in confined spaces, the Superintendents of the Mechanical Contractors shall coordinate their work with the Superintendents of other pertinent trades before installation to assure against interferences. Failure to coordinate such work shall place the responsibility for making any required changes in any trade upon the Contractor who shall have failed to join in the required cooperative effort, all at the direction of the Architect.

3.21 HOISTS, RIGGING, SCAFFOLDING AND TRANSPORTATION

- A. Contractor shall provide all required scaffolding, rigging, staging, tackle, hoists and similar devices and equipment necessary for proper installation of his work, shall remove all temporary materials of this nature when no longer required, and shall be responsible for the safe and lawful use thereof.
- B. Contractor shall be responsible for the transportation of all materials and equipment to the job site, adequate protected storage on site, and all costs of same.

3.22 PROVISIONS FOR LATER INSTALLATIONS

- A. Where work cannot be installed as the structure is being erected, Contractor for such work shall provide and arrange for the building-in of boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Contractor shall arrange for and lay out any chases, holes or other openings which must be provided in masonry, concrete or other work.
- B. Contractor shall be responsible for becoming informed of the nature and arrangement of the materials and construction to which this Contractor's work attaches, members with, or passes through.

3.23 OPERATING INSTRUCTIONS

- A. Contractor shall provide two (2) flash drives, each containing all operating, servicing, lubrication, etc. information and parts lists for all equipment installed under this Contractor's Contract. Material shall be grouped together by trades, each item marked with a tab, and an index shall be provided. Drives to be submitted for approval at least thirty (30) days before completion of the work.
- B. Flash Drives to Include
 - 1. Step-by-step procedures for start-up and shut-down of each system and piece of equipment.
 - 2. Normal equipment operating characteristics.
 - 3. Performance data, curves, ratings.
 - 4. Wiring diagrams.
 - 5. Manufacturer's descriptive literature.
 - 6. Automatic controls with diagrams and written description of operation.

7. Spare parts and replacement list for each piece of equipment.
 8. Name of service agency, installer and suppliers, and their telephone numbers.
 9. Final reviewed Shop Drawings.
 10. Balance report.
 11. Certificates of Tests and Approvals.
 12. Mechanical identification lists (Section 23 0553).
- C. Each flash drive shall also contain all temperature control diagrams applicable to the equipment.
- D. Contractor shall arrange for technical instruction of the Owner's Maintenance Personnel by qualified instructors for such time as is reasonably required to instruct them in the operation and maintenance of all mechanical systems. Instruction period shall be after all systems are in operation, and have been tested, balanced and adjusted. Contractor shall video all training sessions. Two (2) copies of video shall be included with closeout materials for future reference by the Owner.

END OF SECTION 23 0000

SECTION 23 0513 – COMMON MOTOR/ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Single Phase Electric Motors

1.02 RELATED SECTIONS

- A. Section 26 0533 – Raceways
- B. Section 26 2913 – Electrical Control Panels

1.03 REFERENCES

- A. NEMA MG 1 – Motors and Generators; National Electrical Manufacturers Association.
- B. NFPA 70 – National Electrical Code; National Fire Protection Association.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Provide data indicating nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

1.05 QUALITY ASSURANCE

- A. Conform to NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

- A. See Closeout Submittals for additional warranty requirements.
- B. Provide one year manufacturer warranty for motors.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric
- B. Louis Allis
- C. Westinghouse
- D. General Electric
- E. Emerson Electric
- F. Substitutions: See General Requirements

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. The Mechanical Contractor shall furnish all special control items and motors required for the operation of all equipment provided under their sections of the work.
- B. The Electrical Contractor shall furnish all necessary starters and disconnect switches, except on equipment, which is to be provided with starters or disconnect switches as part of the assembly. The Electrical Contractor will furnish all power wiring through starters and disconnect switches to motors.
- C. **Equipment provided with starters shall include phase loss protection as part of the starter package.**
- D. Mechanical Contractor shall provide all power wiring for controls, control and/or interlock wiring required for his particular work. Mechanical Contractor shall also include any wiring required as noted in the individual sections of the Specifications. All wiring required by this Contractor shall be in accordance with provisions as set forth under the National Electric Code and Division 26 Electrical Work of these Specifications.
- E. Where electrical requirements and/or motor horsepowers for the equipment supplied varies from that shown on the Mechanical Drawings or as specifically called out in the Mechanical Specifications, the Electrical Drawings and Specifications shall govern and be adhered to as to electrical power characteristics for the supplied equipment.
- F. Electrical Service:
 - 1. Refer to Drawings
- G. Motor Power Requirements:

1. Motors Under 1/2 HP: 115 volts, single phase, 60 Hz.

H. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1-2011 Part 31, definite purpose inverter-fed motors, limits for insulation class, service factor, and motor enclosure type.

- I. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

J. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

K. AIC (AMP-INTERRUPTING CAPACITY) RATING:

1. All equipment operating at 120/1/60 shall have components with a minimum AIC Rating of 10K.
 - a. 208V
0-50A-10kA
51-150A-25kA
2. Ratings above shall be based on the MOCP required. Refer to mechanical equipment schedules for actual rating of each piece of equipment.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 23 0513

SECTION 23 0529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Hangers and Supports For:

1. HVAC Equipment

1.02 RELATED SECTIONS

- A. Section 23 2113 – Hydronic Piping
- B. Section 23 2114 – Hydronic Specialties
- C. Section 23 2213 – Steam and Condensate Heating Piping
- D. Section 23 2214 – Steam and Steam Condensate Specialties

1.03 REFERENCES

- A. ASME B31.9 – Building Services Piping; The American Society of Mechanical Engineers; (ANSI/ASME B31.9).

1.04 SYSTEM DESCRIPTION

- A. Contractor shall furnish and install all adjustable hangers, special pipe supports, spring hangers, anchors, clamps, rods, and appurtenances as required to securely and properly hang or support the piping systems. Hangers and supports shall be equivalent to the Anvil models specified.
- B. Contractor shall provide all miscellaneous steel and hardware as required to support, hang and secure all equipment, ducts, pipes, etc. as furnished by him, unless such materials are specifically called out to be provided by other Contractors.

1.05 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Include data on hangers and accessories. Provide manufacturers catalogue information. Indicate data and ratings.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Welders: Certify in accordance with ASME (BPV IX).

1.07 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Accept hanger material on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide proper storage.

1.09 EXTRA MATERIALS

- A. See General Requirements for additional provisions.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Where hangers are supported from the building structural steel, they shall be attached to structural members by beam clamps bearing on both sides. Do not weld hanger rods to structural steel. When attaching to bar joists, attach at the panel points only. Attach to concrete decking using expansion bolts or concrete anchors. Anchors in overhead concrete deck and precast concrete panels shall meet ICC-ES AC193 (mechanical anchors) for both cracked and un-cracked concrete.
- B. Ductwork, etc. shall be independently supported from the building structure and shall not be supported from other ducts, pipes, etc. Where interferences do occur, provide trapeze type hangers or supports.

3.02 SCHEDULES

A. Duct Hangers and Supports

1. Hangers for ductwork shall be in accordance with latest SMACNA Standards, "Hangers for Ducts and Upper Attachments". All hanger strap material shall be galvanized. Ductwork shall be supported from the overhead construction using concrete inserts or anchors attached to the concrete. With structural steel and bar joist construction, use welded studs or C-clamps with retaining clip attached to the steel. In all cases, the maximum hanger spacing shall not be exceeded and the hangers shall be readily removable.

END OF SECTION 23 0529

SECTION 23 0593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Testing, Adjustment, and Balancing of Air Systems
- B. Testing, Adjustment, and Balancing of Refrigerating Systems
- C. Measurement of Final Operating Condition of HVAC Systems

1.02 REFERENCES

- A. AABC MN-1 – AABC National Standards for Total System Balance; Associated Air Balance Council.
- B. ASHRAE Std 111 – Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- C. NEBB (TAB) – Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Qualifications: The agency selected shall be a fully certified member of the National Environmental Balancing Bureau or Associated Air Balance Council (ABC), or an independent firm whose principals are registered Professional Engineers.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the Commissioning Authority or Owner Representative within two weeks after completion of testing, adjusting, and balancing.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Include the following on the title page of each report:

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency
- c. Telephone Number of Testing, Adjusting, and Balancing Agency
- d. Project Name
- e. Project Location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project Altitude
- j. Report Date

- D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.04 QUALITY ASSURANCE

- A. All work shall be done with the best modern practices and equipment.
- B. All instruments used for measurement shall be accurate, and calibration for each instrument shall be available for examination. The Architect has the right to request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.
- C. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered Professional Engineer experienced in performance of this Work and licensed at the State in which the Project is located.

PART 2 – EXECUTION

2.01 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Volume dampers are in place and open or adjusted.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.

- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.
- D. The Balancing Subcontractor shall consult all drawings, construction details, job site and confer and cooperate with other Contractors to avoid interference.
- E. The Balancing Subcontractor shall check all control interlocks and cooperate with the Control Contractor in adjusting and calibration of control equipment.
- F. The Balancing Subcontractor shall deliver to the Engineer in writing, all comments regarding the systems and any and all deficiencies found during the balancing of the systems. Preferably this should be done before the final system balance to allow any corrective procedures to take place.
- G. Any ceiling tile that is damaged by the Balancing Subcontractor shall be replaced with new tile identical to that damaged.

2.02 MISCELLANEOUS TESTS

- A. Building pressure tests with outside temperature and wind velocity noted at points of typical location inside building on both lee and windward side of building. Tests to be made with all supply and exhaust systems in normal operation and with supply systems at minimum outside air at approximately nominal wind velocity outside.
- B. Smoke and flame detector tests in conjunction with Control Contractor (Witness Tests).
- C. Record instrument tests to confirm performance of air systems.
- D. All electrical interlocking shall be tested and verified. This work shall be accomplished with a representative of the Heating, Ventilating and Air Conditioning Contractor and Control Contractor present and assisting.

2.03 FINAL OBSERVATION AND ACCEPTANCE

- A. At the time of the final observation and, if requested, the Balancing Contractor shall recheck, in the presence of the Architect, random selections of data (air quantities, air motion), recorded in the certified report. Points or areas for recheck shall be selected by the Architect.
- B. A measured flow deviation of plus or minus 5 percent or more from the certified report listing, at 10 percent or more of the selected recheck stations, shall automatically result in the rejection of the report. In the event the report is rejected, all systems shall be re-balanced and new certified reports submitted and another observation made at no additional cost to the Owner.

- C. Following final acceptance of certified report by the Architect, the settings of all splitters, dampers and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

2.04 INSTRUCTIONS

- A. The Mechanical Contractor shall coordinate with the Test and Balance Contractor the necessary information, data, etc., in order to adequately instruct the Owner's representative in the proper operation and routine maintenance of the mechanical systems. The instruction sessions shall be for a period of two (2) working days (minimum).

2.05 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

2.06 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

2.07 RECORDING AND ADJUSTING

- A. Field Logs: Maintain Written Logs Including:
 - 1. Running log of events and issues
 - 2. Discrepancies, deficient or uncompleted work by others
 - 3. Contract interpretation requests
 - 4. Lists of completed tests
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. TAB Verification: Project Manager shall randomly select measurements documents in the final report to be rechecked. The rechecking shall be limited to 5% of the total measurements recorded or what can be measured in (1) eight hour period.
- G. Seasonal Testing: If initial TAB procedures were not performed during near peak summer and winter conditions, perform additional testing, inspection and adjusting during near peak summer or winter conditions.

2.08 AIR SYSTEM PROCEDURE

- A. Prior to final inspection of the building, all air handling and distribution systems shall be adjusted as necessary to provide required design supply, return, and exhaust air quantities for each component. Balancing of all systems shall be conducted under conditions approximating actual operation.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of ducts and include locations for confirming readings taken. Temperature of the traverse and static pressure existing at the point of traverse shall be noted.
- C. Ducts having velocities of 700 FPM and higher shall have flow measured with inclined manometer having suitable scales and increments.
- D. Ducts having velocities lower than 700 FPM shall have air flow measured with micromanometers, hook gauges, or similar low velocity instruments.
- E. Instrument test holes shall be approved for location and number and shall be re-plugged with permanent closure on completion of work.
- F. Measurement of air quantities at each air inlets and outlets shall be determined by methods approved by manufacturer of terminal or cognizant authority.
- G. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- H. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Volume control by means of air terminal adjustment or duct internal devices other than dampers and splitters are not permitted.
- I. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

- J. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- K. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- L. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- M. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

2.09 SCOPE

- A. Test, Adjust, and Balance the following:
 - 1. Furnaces
 - 2. Air Cooled Refrigerant Condensers
 - 3. Packaged Terminal Air Conditioning Units
 - 4. Fans
 - 5. Air Filters
 - 6. Air Inlets and Outlets

2.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer
 - 2. Model/Frame
 - 3. HP/BHP
 - 4. Phase, Voltage, Amperage; Nameplate, Actual, No Load
 - 5. RPM
 - 6. Service Factor
 - 7. Starter Size, Rating, Heater Elements
- B. Combustion Equipment:
 - 1. Furnace Manufacturer
 - 2. Model Number
 - 3. Serial Number
 - 4. Firing Rate
 - 5. Gas Pressure at Meter Outlet
 - 6. Gas Flow Rate
 - 7. Heat Input
 - 8. Burner Manifold Gas Pressure
 - 9. Heat Output
 - 10. Entering Air DB Temperature, Design and Actual

11. Entering Air WB Temperature, Design and Actual
12. Leaving Air DB Temperature, Design and Actual
13. Leaving Air WB Temperature, Design and Actual
14. Saturated Suction Temperature, Design and Actual
15. Air Pressure Drop, Design and Actual
16. Air Flow, Specified and Actual
17. Return Air Flow, Specified and Actual
18. Outside Air Flow, Specified and Actual
19. Total Static Pressure (Total External), Specified and Actual
20. Fan RPM

C. Air Cooled Condensers:

1. Identification/Number
2. Location
3. Manufacturer
4. Model Number
5. Serial Number
6. Entering DB Air Temperature, Design and Actual
7. Leaving DB Air Temperature, Design and Actual
8. Number of Compressors

D. Exhaust Fans:

1. Location
2. Manufacturer
3. Model Number
4. Serial Number
5. Air Flow, Specified and Actual
6. Total Static Pressure (Total External), Specified and Actual
7. Inlet Pressure
8. Discharge Pressure
9. Fan RPM

E. Duct Traverses:

1. System Zone/Branch
2. Duct Size
3. Area
4. Design Velocity
5. Design Airflow
6. Test Velocity
7. Test Air Flow
8. Duct Static Pressure
9. Air Temperature
10. Air Correction Factor

END OF SECTION 23 0593

SECTION 23 0713 – DUCT INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Flexible Duct Insulation
- B. Rigid Duct Insulation

1.02 RELATED SECTIONS

- A. Section 23 0000 – Basic Heating, Ventilation & Air Conditioning (HVAC) Requirements
- B. Section 23 3113 – Metal Ducts and Duct Liner

1.03 REFERENCES

- A. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 23 0000 for low VOC submittal requirements.
- C. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- D. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 – PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Fiber Glass
2. Johns Manville International, Inc.
3. Owens Corning Corp.
4. Certaineed Corporation
5. Substitutions: See General Requirements

- B. The following ducts shall be externally insulated with 1-1/2 inch thick flexible duct wrap insulation (R4.5 installed), maximum thermal conductivity (k) at 75 degrees F mean temperature 0.27 BTU/hr square foot F degrees/inch, with foil-reinforced Kraft vapor barrier facing. Apply with mastic, mechanical fasteners, staples and tape as per manufacturer's recommendations. Lap and seal all joints. All fastening device penetrations shall be vapor-proofed. Insulation shall be Owens-Corning ED-100-FRK-25.

1. Supply ducts concealed above ceilings and in shafts.
2. Runout ducts to registers, grilles, and diffusers
3. Return ducts concealed above ceilings and in shafts.
4. Outside air ducts concealed above ceiling and in shafts.
5. Exhaust and relief ducts above ceilings and in shafts from backdraft or motorized damper to louver.

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Fiber Glass
2. Johns Manville International, Inc.
3. Owens Corning Corp.
4. Certaineed Corporation
5. Substitutions: See General Requirements

- B. The following ducts shall be externally insulated with 2 inches thick, minimum 3 pound density, semi-rigid fiberglass insulation, minimum R-6 insulation value, maximum thermal conductivity (k) at 75 degrees F mean temperature, 0.23 BTU/hr square foot F°/inch, with foil-reinforced Kraft vapor barrier facing. Apply with pins, mastic and clips as per manufacturer's recommendations. Lap and seal all joints. In exposed areas, i.e. mechanical equipment rooms, welded pins shall be provided with self-locking capped speed washers equivalent to those manufactured by H.A. Jones Company. Cup head pins will also be acceptable. Insulation shall be Owens-Corning 703-FRK.
1. Outside air intake ducts in mechanical equipment rooms.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Duct shall be kept clean and dry during installation.
- D. Any exposed insulated ductwork passing through a floor where it is subject to damage shall be covered with a 0.032 inch (minimum) thick aluminum jacket 18 inches high.

END OF SECTION 23 0713

SECTION 23 2300 – REFRIGERANT PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Piping and Refrigeration Specialty Items
- B. Refrigerant

1.02 RELATED SECTIONS

- A. Section 23 0000 – Basic Heating, Ventilation & Air Conditioning (HVAC) Requirements
- B. Section 23 0719 – HVAC Piping Insulation

1.03 REFERENCES

- A. ASHRAE Std 15 – Safety Code for Mechanical Refrigeration; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- B. ASME B31.9 – Building Services Piping; The American Society of Mechanical Engineers; (ANSI/ASME B31.9)
- C. ASTM B 280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

1.04 SYSTEM DESCRIPTION

- A. The refrigerant piping shall be Type ACR hard copper. All fittings shall be of wrought copper and elbows shall have long radius. All joints shall be made with silver solder, Sil-Fos or Eutectic, while bleeding dry nitrogen through the lines.
- B. Pipe shall be cleaned, dehydrated and pre-charged at the factory and shipped with capped ends. If the interior of the refrigerant piping should become dirty, it shall be cleaned. Cleaning shall entail rodding the pipe with a wire brush and then rodding the pipe with cheesecloth with refrigerant oil on it. At least three passes shall be made with the cheesecloth using a clean cheesecloth with clean refrigerant oil each time.
- C. All refrigeration specialty items shall be Sporlan or Alco. Provide expansion valves, solenoid valves and other specialties as shown and/or as required. Refrigerant piping shall be installed to permit all service work on the compressors including removal of heads, etc.

- D. There shall be incorporated into each refrigerant circuit a refrigerant charging valve, a moisture indicator, a double port liquid line sightglass with extended ends and a liquid line strainer-drier with shutoff valves so that the replaceable core filter-drier can be changed. After startup, replace filter-drier if necessary.
- E. Furnish and install sleeves where the above piping goes through a wall. Sleeves shall be of the same material as the piping. Caulk between piping and sleeves for waterproofing.
- F. Provide protection of refrigerant lines in rigid supports with three or four layers of plastic tape. Where piping is insulated, provide oversize hangers with shields.
- G. Furnish and install necessary operating charges of refrigerant and oil.
- H. Pressure test each refrigerant system.
- I. Each refrigerant system shall be after pressure testing, evacuated before charging. Evacuation with a suitable vacuum pump shall be continued, as required, down to 250 microns. After evacuation a twenty-four hour vacuum test shall be performed to insure tightness of the refrigerant system. After 24 hours, if the vacuum held, system may be charged with refrigerant. If vacuum did not hold, repeat the above steps.
- J. Refrigerant piping must be approved by, and installed in accordance with, the air conditioning equipment manufacturer's recommendations.
- K. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- L. Pre-charge refrigerant piping may be used if systems are 5 tons or less and length of piping is 50 feet or less. After start-up, replace liquid line filter driers, if necessary.

1.05 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 23 0000 for low VOC submittal requirements.

1.06 QUALITY ASSURANCE

- A. Qualifications: Installation of refrigerating equipment shall be performed by skilled mechanics regularly engaged in refrigeration Work.

1.07 REGULATORY REQUIREMENTS

- A. Refrigeration equipment and accessories shall be designed, constructed, tested, installed and shall operate in accordance with the following:
 - 1. ASHRAE 15 Safety Code for mechanical refrigeration
 - 2. Applicable equipment standards of ARI
 - 3. NFPA
 - 4. All local Refrigeration, Fire and Safety Codes

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers seal prior to shipment, until connected into system.

PART 2 – PRODUCTS

2.01 PIPING

- A. Copper Tube: ASTM B 280, H58 hard drawn or O60 soft annealed
 - 1. Fittings: ASME B16.22 wrought copper
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy
- B. Copper Tube to 7/8 inch OD: ASTM B 88, Type K (A), annealed
 - 1. Fittings: ASME B16.26 cast copper
 - 2. Joints: Flared

2.02 REFRIGERANT

- A. Refrigerant: R-410, as defined in ASHRAE Std 34.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration equipment and accessories, as indicated on the Drawings and as Specified, in complete accordance with the manufacturer's instructions.
- B. Install all pipe hangers in accordance with ASME B31.5.
- C. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- D. Provide clearance for installation of insulation and access to valves and fittings.
- E. Provide access to concealed valves and fittings.
- F. Insulate piping and equipment; refer to Section 23 0716 and Section 23 0719.
- G. Follow ASHRAE Std. 15 procedures for charging and purging of systems and for disposal of refrigerant.
- H. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

- A. Test refrigeration system in accordance with ASME B31.5.
- B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch or electronic leak detector.

END OF SECTION 23 2300

SECTION 23 3113 – METAL DUCTS AND DUCT LINER

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Rectangular Metal Ductwork (up to 2 in.w.g.)
- B. Duct Liner / Internal Duct Insulation (up to 2 in.w.g.)
- C. Round Metal Ductwork (up to 6 in.w.g.)

1.02 RELATED SECTIONS

- A. Section 23 0000 – Basic Heating, Ventilation & Air Conditioning (HVAC) Requirements
- B. Section 23 0593 – Testing, Adjusting and Balancing for HVAC
- C. Section 23 0713 – Duct Insulation: External Insulation
- D. Section 23 3313 – Dampers
- E. Section 23 3713 – Diffusers, Registers and Grilles
- F. Section 23 3723 – HVAC Exterior Intakes/Relief Outlets

1.03 REFERENCES

- A. ACGIH (IV) – Industrial Ventilation, A Manual of Recommended Practice; American Council of Governmental Industrial Hygienists.
- B. ASHRAE – HVAC Systems and Equipment Handbook – Latest Issue.
- C. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.
- E. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.
- F. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.
- G. SMACNA (LEAK) – HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; First Edition.
- H. SMACNA (ROUND) – Round Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association.

- I. SMACNA (RIDC) – Rectangular Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 PERFORMANCE REQUIREMENTS

- A. No major variations of duct configuration or sizes permitted unless verified by the Engineer. The right to make minor changes in the run and sizes of ducts during the progress of the work as may be necessary or desirable to avoid local interferences is acceptable. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.
- B. The Sheet Metal Contractor shall fully cooperate with other Contractors in the installation of his work and their work to avoid interferences. It is mandatory that extra care be given to the layout of his work due to the number of services required in some spaces allotted for their installation.

1.05 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. See Section 23 0000 for low VOC submittal requirements.
- C. Product Data: Provide data for factory fabricated ducts and fittings, duct materials, duct liner, duct connections, and sealing agents.
- D. Test Reports: Ductwork shall be tested for tightness according to SMACNA leakage classification. Refer to requirements in this section listed for duct systems up to 6 inches w.g. positive pressure.

1.06 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, SMACNA, ASHRAE standards.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G60/Z180 or G90/Z275 coating.
- B. Steel Ducts: ASTM A 1008, Designation CS, cold-rolled commercial steel or ASTM A 1011A 1011M, Designation CS, hot-rolled steel.
- C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

- D. Hanger Rod: ASTM A 36/A; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 GENERAL DUCTWORK FABRICATION

- A. Sheet metal ductwork shall be fabricated, supported and installed in accordance with the latest ASHRAE and SMACNA recommendations and in the best practices of good workmanship. All ductwork shall be constructed of prime hot dip galvanized sheet steel, except as noted. All duct systems to meet flame spread and smoke contribution requirements of NFPA 90A current edition.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- E. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
- F. Vertical ducts shall be supported from the floor or adjacent wall by substantial angle brackets designed to meet field conditions.
- G. On all air handling units, fans, air conditioning units, etc., duct connections shall be flexible connections using Ventglas 30 ounce, or Durolon 24 ounce material. Canvas will not be acceptable.
- H. Provide a minimum of 1/2 inch clearance for ductwork passing through construction of combustible material. Any duct passing through a wall in an exposed area shall be provided with sheet metal collar flanges and shall form an airtight installation.
- I. To reduce sound transmission between spaces, any wall penetration by a duct above a ceiling shall be closed off. Pack area between wall and duct with fiberglass insulation and provide a sheet metal collar around duct on both sides of wall.
- J. Duct covering shall not extend through a wall or a floor required to be fire-stopped or required to have a fire resistance rating.
- K. Any item that is attached to an externally insulated duct shall be supported with standoffs equal to the insulation thickness.

2.03 CONTRACTOR FABRICATED AND MANUFACTURED DUCTWORK (For Systems Up to 2 Inches W.G. Positive and Negative Pressure)

- A. Ductwork sheet metal gauges, reinforcement, joint construction and support shall be as allowed by the latest ASHRAE and SMACNA HVAC Duct Construction Standards for round and rectangular sheet metal ducts operating at pressures up to 2 inches W.G. In general ductwork in this category includes supply ducts serving single zone units, supply ducts downstream of air terminal units, return air ductwork, exhaust ductwork and transfer ducts. Longitudinal seams shall be Pittsburgh Lock, Acme Lock or Button Punch Snap Lock as shown in the SMACNA Standards for the various duct sizes. Provide cross breaking or beading of ducts as required by these recommendations.
- B. Paint inside of ductwork exposed behind all registers and grilles flat black.
- C. Provide radius elbow in all cases where space will permit use of same. In no case shall the centerline radius be less than 1.0 times the duct width, and if possible, shall be 1.5 times the width. If right angle elbow is necessary in duct, install double blade turning vanes.
- D. Round takeoff from rectangular duct shall be made with a straight spin-in fitting equivalent to Type FLDE by Flexmaster U.S.A., Inc. The mounting groove shall be die-formed to assure constant fit control. Balancing damper shall be factory-installed with positive locking wing nut. Fitting shall include 45 degree air scoop.
- E. All transverse joints and seams on all sheet metal supply, return and exhaust duct systems, including internally insulated ducts, to increase tightness of the system, shall be sealed. Indoor ducts may be sealed using Hard cast Flex-grip 550 liquid rubber sealant. Tape may be used and shall be equal to Hardcast DT-Tape and FTA-20 Adhesive for indoor ducts. Tape shall conform to all Local, State and Federal requirements. Tape shall be so installed that its terminated end does not terminate on the bottom of the duct. Sealants to have a flame spread rating of 25 or lower and a smoke developed rating of 50 or lower. At Contractor's option, mating flanges as manufactured by Ductmate may be used for joining sections of ductwork in lieu of adhesive and tape indicated above.
- F. For final connection of low pressure ductwork to supply air distribution item, flexible duct may be used. The length of flexible duct shall not exceed four (4) feet and shall not be used for more than a final elbow connection to the unit. Duct shall be constructed of inner fabric with helical wire reinforcement and fiberglass insulation with exterior fire retardant vapor barrier. Ductwork shall be UL listed for UL 181, Class1, air duct. Duct to be Type 3 by Flexmaster U.S.A., Inc., or equal as manufactured by Owens-Corning, Johns-Manville, Clevaflex, Hart & Cooley or Anco Products. Secure with adhesive and metal bands.

- G. At Contractor's option, round spiral or longitudinal seam sheet metal duct (up to 24 inches diameter) may be used for rectangular exhaust or unlined return air duct. Round duct to have equivalent area or pressure drop as rectangular duct shown. Tape seal is still required.
- H. Sheet Metal Contractor shall provide internally lined return air elbows as detailed on the Drawings at each return air grille discharging into a return air plenum. Grilles not requiring an elbow will be noted on the Drawings.

2.04 INTERNAL DUCT INSULATION (For Systems Up to 2 Inches W.G. Positive and Negative Pressure)

- A. Internally insulate all rectangular supply and return ducts with 1 inch thick acoustical duct liner with coated face toward the air stream.
- B. Insulation shall meet the Erosion Test Method described in UL Publication No. 181. In addition, all linings, including coatings and adhesives, when tested on a composite basis, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
- C. Insulation shall be applied with mastic and pins as per the manufacturer's instructions and the latest SMACNA Standard. In addition, all joints shall be pinned and a coating of adhesive applied over the exposed edge of insulation.
- D. Insulation shall be a product of Owens-Corning, Johns-Manville or Knauf.
- E. Closed-cell elastomeric foam insulation with self-adhering backing equivalent to AP/Armaflex SA duct liner manufactured by Ameracell will be acceptable.
- F. Duct dimensions shown for rectangular duct are airflow dimensions and do not include an allowance for insulation thickness.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Install in accordance with NFPA 91, SMACNA Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard, and ACGIH Industrial Ventilation Manual except as indicated.

- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect terminal units to supply ducts 3 1/2 feet (maximum) of flexible duct. Flexible duct may only be used for a final elbow or offset connection to the terminal unit.
- I. Connect diffusers to low pressure ducts directly or with 3 feet maximum length of flexible duct held in place with strap or clamp.
- J. Connect flexible ducts to metal ducts with liquid adhesive or liquid adhesive plus tape or draw bands or adhesive plus sheet metal screws.
- K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- L. At exterior wall louvers, seal duct to louver frame and install blank-out panels supplied in Section 08 9100 or and install blank-out panels.
- M. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards – Metal and Flexible for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.

3.02 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

- B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION 23 3113

SECTION 23 3313 – DAMPERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Backdraft Damper
- B. Balancing Damper
- C. Motorized Damper

1.02 RELATED SECTIONS

- A. Section 23 3113 – Metal Ducts

1.03 REFERENCES

- A. AMCA 500-D - Laboratory Methods for Testing Dampers for Ratings
- B. AMCA 511 - Certified Ratings Program for Air Control Devices
- C. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; current edition.
- D. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; current edition, Second Edition with Addendum No.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide for all dampers and their associated hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers, smoke dampers and combination fire and smoke dampers.
- D. Include pressure drop data for all damper sizes in accordance with AMCA 500-D test figures 5.2 (Ducted Inlet, Free Outlet), 5.3 (Ducted Inlet, Ducted Outlet), and 5.5 (Free Inlet, Free Outlet).

1.05 PROJECT RECORD DOCUMENTS

- A. Record actual locations of all dampers.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 – PRODUCTS

2.01 BACKDRAFT DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
 2. American Warming and Ventilating
 3. Greenheck
 4. Louvers & Dampers, Inc.
 5. Nailor Industries Inc.
 6. Pottorff
 7. Ruskin Manufacturing
 8. Vent Products
 9. United Enertech
 10. Substitutions: See General Requirements
- B. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.02 BALANCING DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
 2. American Warming
 3. Greenheck
 4. Louvers & Dampers, Inc.
 5. Nailor Industries Inc.
 6. Pottorff
 7. Ruskin Manufacturing
 8. Vent Products
 9. United Enertech
 10. Substitutions: See General Requirements
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

- C. Manual Balancing Damper: (Ductwork less than one square foot or less than 12 inches high.)
1. Manual balancing damper in low pressure square or rectangular ductwork less than one square foot in area or less than 12 inches high shall be Price Model VCS3, bottom-operated, opposed-blade volume damper or equal as manufactured by the Grille, Register and Diffuser Manufacturers. Permanently attach damper operating rod to damper. Rod to extend at least 3 inches below duct.
 2. In lieu of above provide a Single bladed damper with flat head and sill, synthetic sleeve style bearings and manual quadrant actuator equal to Greenheck Model MBD-10 is acceptable.
 3. Damper in ductwork less than 12 inches round may be shop-fabricated single blade damper.
 4. If duct is externally insulated, provide elevated dial regulators.
 5. Provide dampers where shown and required for air balancing purposes.
- D. Manual Balancing Damper: (Ductwork larger than one square foot or more than 12 inches high)
1. Damper in square or rectangular ductwork larger than the above shall be equal to Greenheck Model VCD-20, opposed-blade, with heavy gauge galvanized steel hat channel frame, flat head and sill on dampers under 14 inches high, 16 gauge steel stops at head and sill, 16 gauge galvanized steel blades and synthetic sleeve style bearings.
 2. Damper in round ductwork 12 inch diameter and larger shall be equal to Greenheck VCDRM-50, opposed-blade, with one piece 14 gauge galvanized steel frame, 16 gauge steel blades and stainless steel bearings.
 3. Locking quadrant for large damper in sheet metal duct shall be Ventlok Model #555 or #560. Locking quadrant for externally insulated duct shall be Ventlok Model #644. Equivalent locking quadrant by damper manufacturer is acceptable.
 4. Provide dampers where shown and required for air balancing purposes.

2.03 MOTORIZED DAMPERS

- A. Galvanized steel motorized damper equal to Greenheck model VCD-23.
1. Performance: Test in accordance with AMCA 500-D. Dampers shall be labeled with the AMCA Air Performance Seal. AMCA certified pressure drop for a 24 in. wide x 24 in. high damper shall not exceed 0.04 in. wg when subjected to an airflow velocity of 1500 fpm according to AMCA Test Figure 5.3.
 2. Frames: Galvanized steel or Stainless steel, welded or riveted with corner reinforcement, minimum 12 gauge. Frames shall be caulked along edges at duct to provide airtight seal.

3. Blades: Galvanized steel or Stainless steel, minimum 16 gauge, attached to minimum 1/2 inch shafts with set screws.
4. Blade Seals: TPE mechanically attached, field replaceable.
5. Jamb Seals: Spring stainless steel.
6. Shaft Bearings: Axle bearings shall be synthetic or stainless steel sleeve rotating in polished extruded holes in the damper frame.
7. Leakage: Dampers shall have a maximum leakage of Class 1 @ 4 in. wg as defined by AMCA (Leakage Class 1 is defined as 8 cfm / sq. ft. @ 4 in. wg).
8. Maximum Pressure Differential: 5 inches wg.
9. Temperature Limits: -40 to 250 degrees F.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics for any dampers with electric motors.

3.02 INSTALLATION

- A. Manufacturer and/or Contractor shall mark extended shaft to assure permanent indication of damper blade position.
- B. Damper shall have a clearly marked operating blade with extendable shaft (rectangular preferred) and with a permanent positioner to prevent shaft from rotating on operating blade.
- C. Damper shall be constructed for velocity and pressure of duct system in which it is installed.
- D. Unless otherwise noted, individual damper blades shall not be over 48 inches long and axle centers are not to exceed 9 inches. Maximum panel size shall be 48 inches wide by 72 inches high.
- E. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3113 for duct construction and pressure class.
- F. Provide backdraft dampers at exhaust fans or in exhaust ducts as near to outside termination point as possible and where indicated.
- G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

- H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Note: If branch fitting with damper is furnished at round take-offs from rectangular ducts, balancing damper in duct may be eliminated.

END OF SECTION 23 3313

SECTION 23 3423 – HVAC POWER VENTILATORS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Ceiling Exhaust Fans

1.02 RELATED SECTIONS

- A. Section 23 0513 – Common Motor/Electrical Requirements for HVAC Equipment
- B. Section 23 3313 – Dampers
- C. Section 26 0533 – Raceways

1.03 REFERENCES

- A. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association.
- B. UL 705 – Power Ventilators; Underwriters Laboratories Inc.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Provide installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acme
- B. Aerovent
- C. Carnes
- D. Greenheck
- E. Jenn Fan
- F. Loren Cook Company
- G. PennBarry
- H. Substitutions: See General Requirements

2.02 PRODUCT REQUIREMENTS:

- A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
- C. Fabrication: Conform to AMCA 99.
- D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- E. Fan shall be AMCA rated for air volume.
- F. The maximum sound level, in sone values or dB (Third octave band) where given represents the highest acceptable value for each fan. The sone value represents loudness levels obtained at (5 feet) from fan inlet. In addition, where applicable, the Fan Schedule lists the maximum tip speed allowable.
- G. Disconnect switch supplied shall be horsepower rated per the National Electrical Code.

2.03 PERFORMANCE

- A. As Scheduled on Drawings

2.04 CABINET AND CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: Fan shall contain rubber isolated direct drive centrifugal fan and have galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected.
- C. Grille: Molded white plastic or aluminum with baked white enamel finish.
- D. Accessories: Solid state speed controller.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof or wall exhausters with cadmium plated steel or aluminum or stainless steel lag screws to roof curb or structure.
- C. Hung Cabinet Fans and In-Line Fans:
1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.
 2. Install flexible connections specified in Section 23 3113 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION 23 3423

SECTION 23 3713 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Diffusers
- B. Registers/Grilles

1.02 RELATED SECTIONS

- A. Section 23 3113 – Metal Ducts
- B. Section 23 3313 – Dampers

1.03 REFERENCES

- A. ASHRAE Std 70 – Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- B. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; Second Edition with Addendum No. 1.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acutherm
- B. Anemostat Products
- C. Carnes Company
- D. Krueger
- E. Metalaire Industries
- F. Nailor Industries
- G. Price Industries
- H. Thermal Products Corporation
- I. Titus
- J. Tuttle & Bailey Mfg. Co.
- K. Substitutions: See General Requirements

2.02 GENERAL

- A. The Drawings show the approximate location of grilles, diffusers and registers. This Contractor shall carefully check the Electrical and Architectural Drawings for the proper placing of grilles, diffusers and registers, and be responsible for supplying the General Contractor with necessary information as to exact location and size of openings required.
- B. Toilet room and janitor closet shall have grilles and registers fabricated of all aluminum construction.
- C. Diffuser or register shall have manually-opposed blade volume control damper as indicated on the Drawings.
- D. Air distribution equipment shall be equivalent to the models and sizes as indicated on the Drawings. This Contractor shall verify the performance and physical size of the other manufacturer's equipment. On the Drawings, the letter indicates the style of outlet and the number following indicates the required capacity of the outlet at full airflow.

2.03 SQUARE AND RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, adjustable pattern, stamped, multi-core diffuser to discharge air in 360 degree or one way or two way or three way or four way pattern with sectorizing baffles where indicated.
- B. Frame: Surface mount or Inverted T-bar. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Steel or Aluminum with baked enamel off-white finish.
- D. Accessories: Radial opposed blade damper adjustable from diffuser face.

2.04 CEILING GRID CORE RETURN REGISTERS/GRILLES

- A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch inch louvers.
- B. Fabrication: Aluminum with factory off-white baked enamel finish.
- C. Frame: Maximum 1-1/4 inch with lay-in mounting or concealed mounting or countersunk screw mounting.

2.05 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades with spring or other device to set blades, vertical or horizontal face, double deflection.
- B. Frame: Maximum 1-1/4 inch with countersunk screw or concealed mounting and gasket.
- C. Fabrication: Steel with prime coat finish or aluminum with factory off-white enamel or clear lacquer finish.
- D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.06 WALL RETURN REGISTERS/GRILLES

- A. Type: Streamlined fixed blades. At 0 degree to 45 degree as scheduled.
- B. Frame: Maximum 1-1/4 inch with countersunk screw or concealed mounting.
- C. Fabrication: Steel or aluminum with factory off-white enamel or prime coat finish.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 23 3713

SECTION 23 3723 – HVAC EXTERIOR INTAKES AND RELIEF/EXHAUST OUTLETS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Louvers

1.02 RELATED SECTIONS

- A. Section 23 3113 – Metal Ducts
- B. Section 23 3313 – Dampers

1.03 REFERENCES

- A. AMCA 500-L – Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.
- B. ASHRAE Std 70 – Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- C. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; Second Edition with Addendum No. 1.

1.04 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.05 QUALITY ASSURANCE

- A. Test and rate louver performance in accordance with AMCA 500-L.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 – PRODUCTS

2.01 LOUVER MANUFACTURERS

- A. Air Balance, Inc.
- B. Airolite Company
- C. All-Lite Architectural Products
- D. American Warming and Ventilating
- E. Greenheck
- F. Krueger
- G. Louvers and Dampers, Inc.
- H. Nailor Industries, Inc.
- I. Pottorff
- J. Ruskin Manufacturing
- K. Safe-Air
- L. Vent Products
- M. United Enertech
- N. Substitutions: See General Requirements

2.02 LOUVER

- A. Provide louver as shown on the Drawings and as specified. Louver shall be complete with frame, sill, birdscreen, anchors and necessary accessories. Louver shall be rigidly braced, reinforced and secured, fastened with cadmium plated bolts and screws. Paint inside of ductwork exposed behind louver dull black.
- B. Louver shall be equivalent to American Warming and Ventilating Company Model LE-21 extruded aluminum louver, 4 inches deep 45 degree drainable blade with 1/2 inch aluminum birdscreen in extruded aluminum frame on the inside edge of the louver. Louver shall have a 204-R1 etch and anodized finish with one coat of lacquer.
- C. Louver shall be weatherproof at a free area velocity of one thousand and fifty feet per minute (1050 FPM) with no moisture carryover.

- D. Louver shall bear the AMCA certified ratings seal for air performance ratings and water penetration ratings.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

END OF SECTION 23 3723

SECTION 23 5400 – FORCED AIR FURNACES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Forced Air Furnaces
- B. Controls
- C. Evaporator Coil
- D. Condensing Unit

1.02 REFERENCES

- A. NFPA 54 – National Fuel Gas Code; National Fire Protection Association
- B. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association
- C. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association

1.03 SUBMITTALS

- A. See General Requirements for submittal procedures.
- B. Product Data: Provide rated capacities, dimensions, clearances, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing for Owners Operating and Maintenance Manual.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer for Owners Operating and Maintenance Manual.

1.04 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Unit shall have a full one (1) year warranty. Provide an extended four (4) year replacement warranty for the refrigeration compressors after the first year full replacement warranty (parts and labor). The four (4) year warranty shall be for compressor replacement only; all labor charges will be the responsibility of the Owner.

1.06 EXTRA MATERIALS

- A. See General Requirements for additional provisions.
- B. Provide two (2) sets of filters for each furnace.

PART 2 – PRODUCTS

2.01 GAS FIRED FURNACES

- A. Manufacturers:
 - 1. The Carrier Corporation
 - 2. Lennox
 - 3. The Trane Company
 - 4. York International Corporation
 - 5. American Standard
 - 6. Goodman
 - 7. Substitutions: See General Requirements
- B. Units: Self-contained, packaged, factory assembled, pre-wired high efficiency unit consisting of cabinet, supply fan, heating element, controls, air filter, intake and exhaust air connections, and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Upflow.
 - 2. Heating: Natural gas fired gas fired.
 - 3. Accessories:
 - a. Concentric Wall Termination Kit
 - b. Evaporator Coil
 - c. Condensing Unit
- C. Cabinet: 22 gauge steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner. For counterflow units, provide additive steel base.
- D. Supply Fan: Direct drive multi-speed blower and motor.

- E. Heat Exchanger: Aluminized and stainless steel tubular type.
- F. Gas Burner:
 - 1. Low energy power venter, vent proving differential.
 - 2. Gas valve, two-stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 3. Electronic pilot ignition, with electric spark or hot surface igniter.
 - 4. Non-corrosive combustion air blower with permanently lubricated motor.
- G. Gas Burner Safety Controls:
 - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Flame Rollout Switch: Installed on burner box and prevents operation.
 - 3. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- H. Operating Controls:
 - 1. Unit shall be provided with a programmable heating/cooling thermostat with "Off-Heat-Cool" system switch and "On-Off" fan switch.
 - 2. Room Thermostat: Cycles burner to maintain room temperature setting.
 - 3. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.
- I. Air Filters: 1 inch thick urethane, washable or glass fiber disposable type arranged for easy replacement. Provide all necessary sub-bases and filter frames for installation as indicated with throwaway filters
- J. Performance: See Schedule on Drawings.

2.02 THERMOSTATS

- A. Manufacturers:
 - 1. White Rodgers
 - 2. Emerson
 - 3. Honeywell
 - 4. The Carrier Corporation
 - 5. The Trane Company
 - 6. York International Corporation
 - 7. Substitutions: See General Requirements
- B. Room Thermostat: Low voltage, electric solid state microcomputer based room thermostat with remote sensor:

1. Preferential rate control to minimize overshoot and deviation from setpoint.
2. Set-up for four separate temperatures per day.
3. Instant override of setpoint for continuous or timed period from one hour to 31 days.
4. Short cycle protection.
5. Programming based on every day of the week.
6. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
7. Battery replacement without program loss.
8. Thermostat Display:
 - a. Time of Day
 - b. Actual Room Temperature
 - c. Programmed Temperature
 - d. Programmed Time
 - e. Duration of Timed Override
 - f. Day of Week
 - g. System Mode Indication: Heating, Cooling, Fan Auto, Off and On, Auto or On, Off

2.03 CONDENSING UNIT

- A. Provide air cooled condensing unit designed for outdoor installation. Unit shall have finished galvanized steel casing that shall house the following equipment:
 1. Hermetically Sealed Compressor
 2. Copper Tube and Aluminum Finned Condenser Coil
 3. Condenser Fan and Fan Motor
 4. Unit shall have a Minimum SEER of 13
 5. Low Ambient Control to 55 degrees F.
- B. Also included shall be all electric safety and operating controls required for operation. Precharged refrigerant tubing will be acceptable.

2.04 EVAPORATOR COIL

- A. Furnace shall be provided with an evaporator coil that shall deliver the indicated capacity on Schedule. Coil shall be factory leak tested, dehydrated, sealed and shipped with a holding charge.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

- B. Verify that proper power supply is available and located correctly.
- C. Verify that proper fuel supply is available for connection.
- D. Verify that water supply is available for humidifier.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.
- B. Mount counterflow furnaces installed on combustible floors on additive base.
- C. Pipe drain from humidifier to nearest floor drain.
- D. Pipe drain from furnace and cooling coil to nearest floor drain. If auxiliary drain is not piped to a conspicuous point of disposal an UL 508 rated water level detecting device shall be provided to shut off the equipment in the event the primary drain is blocked.

3.03 SCHEDULES

- A. See Schedule on Drawings.

END OF SECTION 23 5400

SECTION 23 8126 – SPLIT SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ductless Split System
- B. Controls

1.02 RELATED SECTIONS

- A. Section 23 2300 – Refrigerant Piping
- B. Section 26 0533 - Raceways

1.03 REFERENCES

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.
- B. UL 207 - Refrigerant-Containing Components and Accessories, Non-Electrical; Underwriters Laboratories Inc.

1.04 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Project Record Documents: Record actual locations of components and connections.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 WARRANTY

- A. See Closeout Submittals, for additional warranty requirements.
- B. Unit shall have one (1) year warranty. Provide an extended four (4) year replacement warranty for the refrigeration compressors after the first year full replacement warranty (parts and labor). The four (4) year warranty shall be for compressor replacement only; all labor charges will be the responsibility of the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Mitsubishi
- B. Daikin AC, Inc.
- C. Carrier
- D. Sanyo
- E. LG

2.02 SYSTEM DESIGN

- A. Furnish and install a complete ductless split air conditioning system with the capacity as scheduled. System shall include an indoor fan coil unit, outdoor condensing unit, refrigerant piping and (wired) or (wireless) remote control.

2.03 INDOOR UNIT

- A. Provide indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with cooling coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket, mounting hardware, and thermistor interconnection cable.
- B. Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
- C. Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven horizontal air sweep shall be provided standard. Air sweep operation shall be user selectable. Vertical direction may be manually adjusted and horizontal air sweep may be manually set.

- D. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins will be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.
- E. Motors shall be open drip proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall have 3 speeds.
- F. Provide mounting frames as required for unit installation.
- G. Condensate Pump:
 - 1. The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation and shall not be mounted external to the unit in the space. Pump shall consist of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. The lift capability of the condensate pump shall be 10 feet. A level sensor on the condensate pan shall stop cooling operation if the level in the condensate pan is unacceptable.

2.04 OUTDOOR UNITS

- A. Outdoor Unit:
 - 1. Provide a matching outdoor-mounted, air-cooled split system condensing unit outdoor section suitable for rooftop and grade installation. Unit shall consist of a rotary compressor, an air-cooled coil, draw-thru propeller-type condenser fans, accumulator, cooling refrigerant capillary tubes, refrigerant charge, and control box. Unit shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling system. Provide low-ambient kit.
 - 2. Design is based on refrigerant type HFC-410A. Other HFC refrigerants shall be submitted for Engineer's approval. CFC and HCFC type refrigerants shall not be accepted.
- B. Controls:
 - 1. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 64 degrees F to 84 degrees F.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

END OF SECTION 23 8126

DIVISION 26 – ELECTRICAL
TABLE OF CONTENTS

<u>SECTION #</u>	<u>SECTION TITLE</u>	<u># OF PAGES</u>
<u>Electrical</u>		
26 0500	Electrical General Provisions	11
26 0505	Electrical Related Work.....	4
26 0519	Conductors – Low Voltage	4
26 0521	Metal Clad Cable	7
26 0523	Low Voltage Open Wiring	6
26 0526	Grounding	3
26 0533	Raceways	5
26 0534	Electrical Boxes and Fittings	5
26 0574	Arc Flash Hazard Analysis	8
26 2415	Distribution Panelboards	6
26 2417	Panelboards (Receptacle Panels 120-208V Only)	3
26 2726	Wiring Devices.....	8
26 2813	Overcurrent Protective Devices.....	2
26 2816	Disconnect Switches.....	2
26 2914	Power Equipment.....	3
26 4313	Surge Protective Devices.....	5
26 5100	Interior Luminaires	5
26 5600	Exterior Luminaires	7

SECTION 26 0500 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 1 - GENERAL are part of this Section as if written in full herein. Contractor is held to have familiarized himself with these provisions contained therein.

1.02 DESCRIPTION OF WORK:

- A. This Division shall include all labor, materials, equipment and services necessary for all electrical work, consisting of complete wiring for lighting, power and other systems as shown.
- B. This Contractor shall furnish and install all luminaires and equipment to make a complete and working system as indicated on associated Electrical Plans and/or these Specifications. This will include all wiring requirements from the service entrance to and including final outlets, luminaires, etc. This Contractor shall furnish all necessary outlets and connections to equipment and controls furnished under other Divisions of this Contract.
- C. Raceways only shall be installed for the communication/security systems unless specifically stated otherwise on the Drawings or herein in the Specifications.
- D. This Contractor shall carefully read the general and specific conditions attached hereto, which, with the following Specifications and complete Working Drawings, Details and Addenda, govern all work under this heading.
- E. All electrical work for this project is described in these Specifications or shown on the Drawings.
- F. The Electrical Contractor is responsible for furnishing all material and labor to install and accomplish all work hereinafter described. This shall include all excavation, backfill, tamping, compaction, bases, concrete work, supports, braces, steel, inserts, anchors, chases, sleeves, holes, surveying, etc., required to accomplish all phases of the Electrical Contract, without relying upon other trades or inferring anything that is mentioned in other Divisions of this Specifications, unless it is specifically stated in the Electrical Specifications or noted on the Drawings that it is to be furnished or provided by another trade.
- G. If a specific item such as an electric heater is specified on both Electrical Drawings and Mechanical Drawings, the Electrical Contractor shall include all items in his bid regardless of other trades. Resolution will be by Addendum or Change Order.

- H. Site Visitation: Examination of the site shall be made by this Contractor, who shall compare it with the Drawings and Specifications and shall satisfy himself as to all the conditions under which the work is to be performed. Contractor shall ascertain and check the location of any existing structures or equipment which may affect this work.
- I. It shall be the responsibility of this Contractor to refer to any discrepancies upon examination of the site and/or Drawings to the Engineer/Architect before bid due date.
- J. No variances, changes, substitutions or extras will be permitted because of the Contractor's unawareness of existing conditions.
- K. No allowances shall be made on his behalf for any extra expense due to failure or neglect on his part to make such examination.
- L. Work by Others: All motors for building utility equipment will be furnished and installed under other Divisions of these Specifications, but shall be connected hereunder.

1.03 DRAWINGS:

- A. The Drawings accompanying these Specifications are complementary to them. What is called for by one shall be considered as though called for by both, unless specifically stated or shown otherwise.
- B. The wiring layout is schematic and the exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be changed. It refers only to the exact locations of conduits and equipment to fit into the building as constructed and the coordination of conduit and other equipment with piping and equipment included under other Divisions of the Specifications.
- C. The exact location of conduits and equipment not located by dimensions on the Drawings shall be determined in the field considering interferences and appearance. Minor changes in the location of equipment from that shown on the Drawings shall not constitute a reason for extra charges.
- D. The Drawings illustrate the work specified and are intended to agree in every respect with one another and with these Specifications. All discrepancies that appear shall be brought to the attention of the Engineer/Architect for correction. No omission from any Drawings shall release the Contractor from furnishing equipment or materials called for by the Specifications or other Drawings.
- E. The Contractor shall consult both floor plans and risers when taking "counts" of devices, such as fire alarm, sound systems, etc.

- F. The Contractor shall consult approved casework shop drawings before rough-in.
- G. The Plans and Specifications are intended to include everything obviously necessary for the entire finishing of the work under this heading. Accordingly, all work is to be done to provide a complete installation in accordance with the Plans and Specifications whether each item is mentioned herein or not.
- H. Consult all Contract Drawings which may affect the location of any item to secure coordination. Item miscoordination that constitutes changes, other than minor adjustments, shall be submitted to the Engineer/Architect for approval before proceeding with the work.

1.04 COORDINATION WITH WORK OF OTHER TRADES:

- A. This Contractor shall examine work of other trades which comes in contact with or is covered by his. He shall, in no case, attach to, cover up, or finish against defective work. This Contractor shall consult all Drawings and Details, both architectural and mechanical.
- B. All outlets, switches and receptacles shall be centered with regard to paneling, trim, equipment, etc.
- C. Failure to observe the above requirements will result in correction to be made at the expense of this Contractor. This Contractor shall furnish and install appropriate sleeves and hangers required in his work.

1.05 BASIC MATERIALS:

- A. All materials shall be of best quality, new and approved by Underwriters Laboratories, Inc. where such approval is applicable. Materials specified by manufacturer's catalog number shall be as specified unless "or equal" substitutions are authorized by the Engineer/Architect.
- B. Should the Contractor desire to furnish materials or equipment by manufacturers not named in the contract documents, he shall request permission to substitute. The Contractor shall furnish such Drawings, Specifications, performance data, samples and other information as may be required to assist the Engineer/Architect and Owner in determining whether the proposed substitution is acceptable.
- C. Approval of requests for substitution of products or processes other than those specified will be contingent upon submission of proof, satisfactory to the Engineer/Architect and Owner, that:
 - 1. The proposed substitute is equal or superior in quality and serviceability to the specified products or processes.

2. Its use will not entail changes in details and construction or in design and artistic effect.
 3. The Contractor will provide the same warranty for the substitution that he would for the product specified.
- D. All requests for substitutions shall be submitted to the Engineer/Architect no later than 14 days before bid due date.
- E. It is to be emphasized that the Contractor's base bid shall be based on equipment named in the Specifications. Submission of substitute items of equipment by any bidder, contractor or manufacturer shall be in no way binding on the Owner or Engineer/Architect for acceptance or rejection. Final approval of all equipment and materials shall be made only after final test and acceptance of the project.

1.06 QUALITY ASSURANCE CODES, STANDARDS, PERMITS AND SYMBOLS:

- A. Imposed Codes and Standards: Applicable provisions of the following codes and standards are hereby imposed on a general basis for the electrical work in addition to specific applications specified by individual work sections of these Specifications.
- | | | |
|-----|------|---|
| 1. | ACIL | American Council of Independent Laboratories |
| 2. | ANSI | American National Standards Institute |
| 3. | ASTM | American Society for Testing & Materials |
| 4. | AWS | American Welding Society, Inc. |
| 5. | FM | Factory Mutual Engineering Corp. |
| 6. | FS | Federal Specification (General Services Admin.) |
| 7. | MIL | Military Standardization Documents |
| 8. | NEC | National Electrical Code (NFPA No. 70) |
| 9. | NEMA | National Electrical Manufacturers Association |
| 10. | NFPA | National Fire Protection Association |
| 11. | OSHA | Occupational Safety & Health Administration |
| 12. | UL | Underwriters' Laboratories, Inc. |
- B. Tests and Permits: Demonstrate by tests, at the request of the Engineer/Architect and Owner, the compliance of the installation with these Specifications, the Drawings, the National Electrical Code, and the accepted standards of good workmanship. These tests shall include operations of lights and equipment, continuity of the conduit system, grounding resistance and insulation resistance measurements on not more than ten representative circuits and any other circuits for which a justifiable reason exists for such tests. All labor and testing equipment for the performance of these tests shall be furnished by this Contractor.
- C. This Contractor shall pay for all permits required for the execution of his work.

1.07 SUBMITTALS:

A. Shop Drawings:

1. Submit electronic copies in pdf format of detailed Shop Drawings of all items of equipment furnished under this Contract for approval, before manufacture of the equipment or its incorporation in the work. Drawings shall be submitted covering panelboards, dry type transformers, lighting fixtures, electronic ballasts for fluorescent fixtures, wiring devices, motor controls, fire alarm system, etc.
2. Shop Drawings will not be reviewed by the Engineer/Architect if the Contractor's stamp and initials are not on the drawings showing that the Contractor has first approved Drawings.
3. If quantities appear on the Drawings, they will be marked out. The Engineer/Architect will not approve quantities. This is the Contractor's responsibility.
4. If standard catalog sheets containing numerous numbers, such as fixture types, are submitted without being marked for identification, they will be returned for resubmission.
5. Shop Drawings of distribution switchboards or panelboards and motor control centers shall include full front elevations indicating all fusible switches, breakers, starters, etc. Dimensioned space for future branch switches, breakers and/or starters shall be included on the elevation.
6. Shop Drawings/Submittals as required for Arc Flash Program shall be submitted for review and approval prior to commencement of study and prior to submittal of final report.
7. Shop Drawings of Equipment Furnished by Others: The Contractor will be provided with complete manufacturer's detailed Shop Drawings, wiring and connection diagrams of all equipment to which his work connects. It shall be the Contractor's responsibility to obtain the Drawings from other Contractors or suppliers at the time they are needed. Work that must be altered because of the Contractor's failure to obtain shop drawings shall be corrected without additions to the Contract Price.

B. Electronic Format:

1. Shop drawings may be submitted in electronic format utilizing PDF files. The submittal shall be organized by specification section and contain all required information within a PDF document for each specification section. The submittal shall be organized as follows:
 - a. Primary zip file contains a PDF of master transmittal cover page indicating the project name, submitting contractor, contact information and a list of all the sections with titles being submitted. This primary file shall also contain each of the individual PDF files for the individual sections being submitted.
 - b. Sub PDF file for each specification section organized as follows:

- 1) First Page: Cover page indicating the project name, submitting contractor, contact information, space for Engineer's stamp.
- 2) Page(s) for contractor qualifications and project certifications.
- 3) Page(s) for Bill of Materials (BOM) list including part numbers, quantities and references to specification section paragraphs for each part.
- 4) Page(s) for manufacturer's data sheets.
- 5) Page(s)/Drawing(s) for system diagrams, riser diagrams, block diagrams, etc.
- 6) Drawing(s) for floor plans showing equipment locations.

C. Material List:

1. The successful Contractor shall upon award of the Contract, submit a material list for approval on the following items. Eight copies of the list shall be submitted:
 - a. Toggle Switches
 - b. Receptacles
 - c. Device Plates
 - d. Lamps and Ballasts
 - e. Panelboards
 - f. Switchgears
 - g. Lighting Fixtures
 - h. Lighting Fixture Ballasts
 - i. All Special Systems
 - j. Arc Flash Study/Report
 - k. Fittings
 - l. Conduits
 - m. Wire
 - n. Boxes

D. Record Drawings:

1. The Contractor shall keep in the field, and open to inspection, an accurate, current, progressive record of the actual installation of the Electrical System. On completion of the work, the Contractor shall deliver marked prints showing the actual routing of the conduits and ducts, locations and elevation of outlets, circuit numbers of all lighting and power circuits, installation details of lighting fixtures, power panels, etc.

E. Operating Instruction Manuals:

1. Provide written instructions for each system listed in the Specifications.
2. Submit two (2) copies to the Engineer/Architect for approval.

3. After approval, submit four (4) copies to the Engineer for delivery to the Owner.
 4. Bind the written operating instructions, shop drawings, equipment catalog cuts and manufacturer's instructions into a hardback binder where they can be accommodated into 8-1/2 inch x 11 inch size. Material to be assembled as follows:
 - a. First Page: Title of job, Owner, address, date of submittal, and name of Contractor.
 - b. Second Page: Index
 - c. Third Page: Introduction to first section containing a complete written description of the system.
 - d. First Section: Written description of system contents, where actually located in building, how each part functions individually, and how system works as a whole. Conclude with a list of items requiring service and either state the service needed or refer to the manufacturer's data in the binder that describes the proper service.
 - e. Second Section: Manufacturer's instruction.
 - f. Third Section: Shop Drawings and equipment catalog cut sheets.
- F. Record drawings and Operating Instruction Manuals must be submitted before final payment is approved.

PART 2 - PRODUCTS

2.01 PRODUCTS, ELECTRICAL WORK:

- A. It is to be emphasized that the Contractor's Base Bid shall be based on equipment named in the Specifications. Submission of substitute items of equipment by any Bidder, Contractor, or Manufacturer shall be in no way binding on the Owner or Engineer for acceptance or rejection. Final approval of all equipment and materials shall be made only after final test and acceptance of the project.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Perform all work in accordance with the latest edition of the National Electrical Code, OSHA, state and local codes which apply.
- B. All workmanship shall be in accordance with the best practices of the trade. Electrical work shall be installed by journeyman electricians under the direct supervision of a competent foreman. At no time shall electrical work be without the immediate on-the-job supervision of a journeyman electrician.

- C. Balance load on feeders and main switch to within 10% under maximum load conditions.
- D. This Contractor shall at all times keep himself fully informed of the progress of the general construction and shall install all of his work that is concealed and built into the building in place in sufficient time to insure proper location without delays in the work of the other trades. Properly attend the electrical work during the progress of the building-in to prevent misalignments or damage to the electrical work.
- E. Cutting through floors and into columns, walls or partitions made necessary in order to install this work must be done under the direction of the Engineer, and only with the Engineer's written approval. All cutting of masonry fireproofing made necessary for the installation of Electrical Work shall be repaired by this Contractor as directed by the Engineer.
- F. Upon completion of work, the entire installation will be inspected and tested to see that the requirements of these Specifications have been fully complied with before the final payment will be approved.
- G. Penetration of metal roof deck is not permitted for hangers, clamps, fasteners, etc.
- H. In areas without suspended ceilings, fixtures located between structural members shall be supported from unistrut.
- I. Provide all additional supplementary support as may be required. All supports shall be by an approved system such as "unistrut". Supports composed of channel iron, conduit, wire or other non-approved material shall not be acceptable.
- J. Prepare all fittings, boxes, supports and panelboards exposed for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent scratching or defacing of all electrical apparatus and devices.
- K. Exposed conduit installed after room has been painted shall be painted to match room finish by this Contractor.
- L. No conduits, cables, boxes, devices, etc., shall be attached to wires that support ceiling suspension system.
- M. All incandescent fixtures, speakers, smoke detectors, clocks, etc., attached to or suspended from grid ceilings shall be supported from the main T-bars, not the intermediate T's.
- N. Install conduit expansion fittings (O.Z. Gedney or approved equal) at all conduits passing through building expansion joints.

- O. Install cable barriers with sealing block assemblies (Crouse-Hinds, Nelson, or 3M) at all cable tray penetrations of fire-rated walls or floors.
- P. Openings around conduits or in sleeves for conduits penetrating fire-rated floor slabs, walls, partitions, ceilings or smoke partitions, shall be sealed at both sides of the penetration.
- Q. The Contractor shall verify with the Architect and/or the local building authority, the fire rating requirements of any wall or floor to be breached by a conduit, cable, raceway or other penetration as per ASTM E-119 (NFPA-251 and UL-263) standards. The Contractor shall notify the Engineer, Architect and Owner in writing of all existing non-compliant conditions for resolution. The presence of existing non-compliant conditions will not exempt the Contractor from meeting the installation fire rating requirements.
- R. The Contractor shall provide through penetration firestops as per ASTM E-814 and UL-1479.
- S. All firestopping systems shall be of a single manufacturer.
- T. This Contractor shall rough-in and then completely connect up after equipment installation by others, all equipment as detailed on the drawings and specified herein. Electrical outlets and approximate loads for the various items of equipment are noted on the Drawings. It shall be the responsibility of the Contractor to verify exact locations of such outlets serving various equipment units, as well as to verify the equipment manufacturer's required circuit termination methods to best suit requirements for each equipment item (e.g., blank box, plug-in, receptacles, etc.). Compliance with such requirements of the equipment manufacturer shall be a part of the contract and shall be met without additional expense to the Owner.
- U. All adjustable luminaires shall be aimed after final placement of plants, furniture, equipment, etc.
- V. All recessed fluorescent luminaires shall be securely fastened at each corner to the ceiling framing members by mechanical means such as screws or rivets. Surface mounted fluorescent luminaires shall be securely fastened at each end to the ceiling framing members by mechanical means such as screws or rivets.
- W. The Contractor shall use all care possible to avoid soiling the floors and walls. No cutting, threading, or bending of conduit will be permitted in building areas where finished floors have been installed, unless the floors are covered or protected. If floors are damaged, they shall be refinished to the satisfaction of the Engineer/Architect.
- X. Nameplates: Provide nameplates on all equipment of the type listed in the following schedules:

1. Panelboards
 2. Switchboards
 3. Motor Starters
 4. Safety Switches
 5. Bus Plug-In Units
 6. Control Panels
 7. Control Devices
 8. Telephone Cabinets
 9. Emergency System Equipment
 10. Transformers
 11. *Current Transformer (CT) Cabinet (*Nameplate shall read "CT Cabinet and Meter are not a disconnecting means")
- Y. Lettering shall include name of equipment, the specific unit number, and any reference to "ON"-"OFF" or other instructions that are applicable.
- Z. Nameplates shall be laminated phenolic with a white surface and black core. Items connected to an emergency power source shall have a red surface and white core. Use 1/16 inch thick material for plates up to 2 inch x 4 inch; for larger sizes use 1/8 inch thick material.
- AA. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4 inch minimum height letters which occupy four to the inch. Increase letter size to 3/4 inch on the largest plates.
- AB. Warranty: This Contractor shall warranty his entire electrical installation against defects in workmanship and materials for a period of one year after the date of acceptance by the Owner, ordinary wear and tear excepted, or such longer period as specified in the Contract Documents. Upon written notice from the Owner this Contractor shall remedy all such defects at his own expense and at a time convenient to the Owner.
- AC. Inspections: This Contractor shall, at the conclusion of the installation secure a Certificate of Inspection, properly signed by the Controlling Building Department which shall state that all codes have been complied with and the work is satisfactory. The Contractor shall give notice to the proper authorities in ample time so that work can be inspected and approved as it progresses.
- AD. Immediately correct all work which is found unacceptable by the Engineer/Architect; work shall be considered unacceptable when it is contrary to the Drawings and/or Specifications and/or the National Electrical Code and/or accepted standards of good workmanship.

AE. Temporary Lighting and Electric Power:

1. This Contractor shall provide temporary general lighting and power in accordance with OSHA standards. Temporary electrical power shall consist of a minimum of one double duplex receptacle with ground fault protection, installed in the electrical room on each floor. 120-Volt receptacles with ground fault protection shall be installed so that no subcontractor will be required to use extension cords in excess of 75 feet-0 inch. Provide and maintain a minimum of 1/2 Watt per square foot for power and a minimum of 20 footcandles for lighting. Special temporary wiring for lighting, including all additional lighting for special finishes, and electrical power requirements over those specified, shall be the responsibility of the individual Contractor.
2. If suitable power is not available on site, the Contractor shall provide temporary power from the local utility including all poles, transformers, meters, etc., and including all power company installation charges.
3. If the cost of power is to be borne by the Contractors, it shall be done on a percentage basis according to contract award and divided among all project Contractors.
4. The Contractor shall remove all temporary wiring at close of contract, including all wiring, panels, etc., installed under previous contracts.

AF. Noise Limitation: Perform all work to assure minimal noise produced by the electrical equipment and installation.

AG. Check and tighten all plates, covers, doors, and trims used in conjunction with electrical equipment. All outlet openings not receiving a device shall be provided with a blank plate. There shall be no "open" boxes.

AH. Remove and replace any device or equipment which is found to emit noise level higher than industry standards. Perform all work in accordance with the field instruction issued by the Engineer/Architect to alleviate such conditions.

AI. Upon completion of the work, this Contractor shall remove all debris, tools, machines, etc., pertaining to this work and shall leave the area broom clean. The work, including luminaires, shall be thoroughly cleaned and ready for use by the Owner. The Contractor shall be responsible for maintaining clean and safe conditions in the area of his work.

AJ. Due to Arc Flash hazards, any work required on electrical equipment that is energized shall be with written permission from the Owner. The Electrical Contractor shall require employees to wear the proper personal protection (PPE) equipment required in NFPA-70E, 130.7 (c)(9).

END OF SECTION 26 0500

SECTION 26 0505 - ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical related work specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical related work required by this section is indicated on drawings and/or specified in other Division-26 sections.
- B. Types of electrical related work specified in this section include the following:
 - 1. Hazardous Classified Areas
 - 2. Cutting and Patching for Electrical Work
 - 3. Excavating for Electrical Work
 - 4. Concrete for Electrical Work

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of products for mechanical related work of sizes, types, ratings, and materials required, whose products have been in satisfactory use in similar service for not less than three years.
- B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with electrical related work similar to that required for this project.
- C. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed and labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- D. Concrete Work Codes and Standards: Comply with governing regulations, and where not otherwise indicated, comply with the following industry standards, whichever is the most stringent in its application to work in each instance:
 - 1. OSHA Department of Labor Occupational Safety and Health Administration 29CFR of the Federal Register
 - 2. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 3. ACI 311 "Recommended Practice for Concrete Inspection".
 - 4. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 5. ACI 347 "Recommended Practice for Concrete Formwork".

6. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 7. Concrete Reinforcing Steel Institute's "Manual of Standard Practice".
- E. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.
- F. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

PART 2 - PRODUCTS

2.01 ACCESS TO ELECTRICAL WORK:

- A. Access Doors:
1. General: Where floors, walls, and ceilings must be penetrated for access to electrical work, provide types of access doors indicated, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete unit, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
 2. Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gauge frames and 14-gauge flush panel doors; 175 degree swing with concealed spring hinges; flush screwdriver operated camlocks; factory-applied rust-inhibitive prime-coat paint finish.

2.02 HAZARDOUS CLASSIFIED AREAS:

- A. Conduit, raceway, boxes, devices and wiring methods in hazardous classified areas as defined by N.E.C. Article 500 shall be installed in accordance with N.E.C. Article 501, 502 and 503.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING:

- A. Avoid cutting into work by others by using sleeves, insets, chases, etc. The Contractor in whose work it shall be necessary to use any of these methods shall build same into his work, but this Contractor shall be responsible for the correct sizes and locations of same and shall furnish all sleeves and inserts. All sleeves and inserts shall be furnished in ample time so as not to cause delay of other trades.

- B. If necessary to cut into the work of another Contractor, it shall be done by this Contractor at this Contractor's expense. Any patching made necessary by such cutting shall be performed by this Contractor per Engineer/Architect's approval.
- C. Cutting shall be done with such tools and methods as will prevent damage to surrounding building areas or equipment, and shall be performed in a neat and orderly manner.
- D. No cutting shall be done which will in any way reduce the structural strength of the building. Should such cutting be found necessary, the Engineer/Architect must first be fully informed of and consent to the proposed operation.

3.02 EXCAVATION, BACKFILL AND CONCRETE WORK:

- A. Excavation and backfill required for the execution of the Electrical Work shall be included in the Electrical Contract.
- B. Backfill material shall be granular or approved excavated material. Backfill material, compaction requirements, etc. shall be as specified in the General Section of these Specifications.
- C. Concrete work for electrical equipment pads, bases, etc. shall be included in the Electrical Contract.
- D. Excavation shall include removal of debris within the trench path. Debris shall be inclusive of but not limited to the following items: abandoned sections of manholes, gravel, rocks, concrete pads, abandoned foundations, abandoned conduit, and abandoned piping. Boring through abandoned foundations, manholes and other abandoned subterranean obstacles is permitted. Impediments not abandoned shall be circumvented around, under, over or through as directed by the Engineer. The Electrical Contractor shall inform the Engineer when solid obstacles larger than a cube 4' on a side are encountered.
- E. Excavating within 12" of marked utility equipment shall be performed utilizing hand excavating or "wash & vacuum" equipment to remove soil.

3.03 ASPHALT PAVEMENT REPAIR:

- A. Where asphaltic pavement is cut, cracked, or in any other way damaged by construction or related activities, Electrical Contractor shall replace as follows:
 - 1. Asphalt shall be saw-cut and removed in a straight line, perpendicular to the direction of roadway or walk.
 - 2. New pavement shall conform to ODOT Items 402 and 404. Thicknesses shall match existing.

3. New asphalt in parking areas shall be sealed with two (2) applications of coat tar pitch emulsion, meeting all requirements of federal specification R-P-355D. The first application shall be loaded with sand at a rate of 6 lbs. of sand per gallon of sealer. Sealer shall not be diluted with water beyond the manufacturer's recommendations. Rate of application shall meet the manufacturer's recommendations.
4. Asphalt shall be placed in two (2) compacted lifts.
5. New asphalt joints shall be sealed with a non-tracking, rubberized asphaltic crack filler. AC 20 shall not be allowed. An oil bath, double jacketed, agitated melting kettle shall be used for preparation of this product, "HiSpec" by W.R. Meadows or equal.

3.04 SIDEWALK AND CURB REPAIR:

- A. Walk thickness to be a minimum of 5 inches for walks.
- B. Sidewalks shall be replaced back to a joint.
- C. Repair curbs to like kind, and replace back to a joint.

END OF SECTION 26 0505

SECTION 26 0519 – CONDUCTORS – LOW VOLTAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division Section making reference to electrical conductors.

1.02 DESCRIPTION OF WORK:

- A. Types of electrical wire, cable, and connectors specified in this section include the following:
 - 1. Copper Conductors
 - 2. Fixture Wires

1.03 QUALITY ASSURANCE:

- A. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic-Insulated Wires and Cables", and Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
- B. UL Compliance: Provide wiring/cabling and connector products which are ETL-listed and labeled.
- C. NEMA/ICEA Compliance: Comply with NEMA/ICEA S-105-692, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables", pertaining to electrical type wires and cables.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Stds 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std 2141, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F).
- F. FS Compliance: Comply with Federal Specifications J-C-30, "Electrical Cable and Wire, (Power, Fixed, Installation)", and W610, "Splice Conductor".
- G. Wire size, insulation type and the manufacturer's name or UL file number shall be permanently marked on the conductor at regular intervals.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. Minimum size wire for lighting and power feeders and branch circuits (20 ampere) shall be No. 12 AWG copper. Minimum size wire for control circuits shall be No. 14 AWG copper. All wire shall be stranded.
- B. All conductors for feeders 100A (No. 2 CU / No. 1 AL) and larger shall be Type XHHW THHN/THWN copper, or Type XHHW-2 annealed aluminum alloy (Alcan Stabiloy AA-8000 Series or approved equal) 600-Volt, unless otherwise noted on the Drawings. Conductors shall be insulated with virgin cross-linked polyethylene insulation.
- C. All conductors for feeders smaller than 100A (No. 2 CU / No. 1 AL) shall be Type THHN/THWN copper, 600-Volt, unless otherwise noted on the Drawings. The conductors shall be insulated with virgin PVC compound and shall have an overall extruded nylon jacket. Nylon "skim" or "dip" coating will not be acceptable.
- D. A green ground wire sized according to the NEC Table 250-122 shall be installed in all flexible conduit and kept isolated from the white neutral wire.
- E. All wire and/or cable shall be delivered to the job site in full factory lengths of 500'-0" minimum. Longer reels may be used where conditions dictate.
- F. Factory "shorts", scrap or warehouse and prior job "clean-outs" (leftovers) will not be acceptable.
- G. All wire and cable submitted shall be in conformance with the Specifications detailed herein and shall include the manufacturer's published statement of warranty.
- H. Approved manufacturers are Aetna, American Insulated, Encore, Superior Essex, Prysmian, and Southwire.
- I. If any wire, other than by the above manufacturers, is found on the project, the Electrical Contractor shall remove the wire and replace it with one of the above manufacturers. Submit the name of the wire manufacturer on the material list.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Swab conduits free of moisture, dirt and grease before pulling the wire.

- B. The best care shall be exercised while installing wire in conduits so as not to injure the conductor insulation. Use only approved wire pulling lubricants for pulling in conductors.

3.02 JOINTS:

- A. Conductors shall not be spliced unless specifically called for on the Drawings or with written permission from the Owner or Engineer.
- B. Joints and splices shall be made only at accessible boxes.
- C. Joints in No. 8 and smaller wire shall be made with Minnesota Mining and Manufacturing Company's preinsulated "Scotchloks". Joints No. 6 and larger wire shall be made by pressure type mechanical connectors, insulated with three layers half-lapped, "Scotch No. 33"; terminal connections shall be made using solderless Scotchlok pressure type lugs and connectors.
- D. Joints in No. 8 to No. 2/0 wire in damp locations, exterior junction boxes and pole bases shall be made with water resistant setscrew, gel filled connectors; Raychem Gelcap SL Insulating Splice Kit. Joints in No. 10 and smaller in damp locations, exterior junction boxes and pole bases shall be made with gel filled wire nuts; Ideal Twister DB Plus or Buchanan BTS Twist & Seal Water Resistant Connectors.
- E. Free ends and loops of wire at boxes and enclosures shall be pushed back in box and protected by blank covers or other means until the interior painting or decorating work of the General Contract is completed.

3.03 GENERAL:

- A. Color coding of multi-wire branch circuit for lighting and outlets shall be in accordance with the National Electrical Code. The grounded neutral shall be identified white for 120-Volt circuits and gray for 277-Volt circuits throughout, without exception, beginning at the service entrance equipment. The identified neutral shall be insulated throughout and grounded only at the service entrance equipment (not individual panels).
- B. The green ground wire shall be installed and kept isolated from the white neutral wire.
- C. Branch circuits and control circuits shall be connected as numbered on the Drawings or are to match some numbered or coded system. Test and permanently tag by circuit number each control wire and circuit wire, except neutrals, in panel gutter before connecting to panels, using numbered tapes. Tapes shall be Scotchcode Epoxy film tapes.

- D. Each 120-Volt or 277-Volt branch circuits shall be installed with a dedicated neutral wire from the circuit source to the load connection, unless specifically indicated otherwise on the drawings.
- E. HVAC Equipment (Fans, motors, condensing units, chillers, cooling towers, etc.) that are fed with a branch circuit that is 100A or larger shall have the conductors terminated into a copper pigtail adaptor at the equipment connection end of the branch circuit conductor. The pigtail adaptor shall be dual rated, UL listed for dual rated (copper/aluminum) connections, include a copper conductor, fully rated for conductor ampacity; IIsco CPM series or equal.

END OF SECTION 26 0519

SECTION 26 0521 – METAL CLAD CABLE

PART 1 - GENERAL

1.01 SUMMARY:

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. Metal Clad (Type MC) Cable – Power, Control and Lighting Systems.
2. Wiring connections and terminations.

C. Related Sections:

1. Division 01 Section "General Requirements"
2. Division 01 Section "Special Procedures"
3. Division 07 Section "Penetration Firestopping"
4. Division 26 Section "Common Work Results for Electrical"
5. Division 26 Section "Electrical Conduit"
6. Division 26 Section "Boxes for Electrical Systems"
7. Division 26 Section "Cable Trays for Electrical Systems"
8. Division 26 Section "Secondary Grounding for Electrical Systems"

1.02 REFERENCES:

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.
4. Refer to Division 26 Section "Common Results for Electrical" for codes and standards, and other general requirements.

B. ANSI/NFPA 70 – National Electrical Code

C. ANSI – American National Standards Institute:

1. ANSI/UL 1569 – Metal-Clad Cables

2. ANSI/UL 514B – Conduit and Cable Fittings
 3. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes and Conduit Bodies For Conduit and Cable
- D. Institute of Electrical and Electronics Engineers (IEEE)
- E. Insulated Cable Engineers Association (ICEA)
- F. ASTM International
- G. NEMA – National Electrical Manufacturers Association:
1. NEMA WC 70 Non Shielded Power Cables rated 2000Volts or Less for the Distribution of Electrical Energy
- H. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- I. UL – Underwriters' Laboratories

1.03 SUBMITTALS:

- A. Submit product data for metal clad cable and fittings.

1.04 QUALITY ASSURANCE:

- A. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc., or by a nationally recognized testing laboratory (NRTL).
- B. Electrical equipment and materials shall be new and within one year of manufacture, complying with the latest codes and standards. No used, re-built, refurbished and/or re-manufactured electrical equipment and materials shall be furnished on this project.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to site in unopened cartons or bundles as appropriate, clearly identified with manufacturer's name, Underwriter's or other approved label, grade or identifying number.
- B. Refer to construction drawings for the type of the cables to be furnished and installed under this project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Cablec Continental Cable Co.
- B. General Cable Corp.
- C. Okonite Co.
- D. AFC Cable Systems
- E. Engineer approved equal

2.02 CABLE ASSEMBLY:

- A. Metal clad cable assemblies shall consist of 2, 3 or 4 current carrying conductors and an equipment ground conductor as specified on the Construction Drawings.
- B. Conductors: Class B stranded copper conductor, No. 12 AWG minimum or No. 10 AWG maximum. Installation methods shall be as specified under Part 3 – Execution.
- C. Insulation: Conductor insulation shall be 600 volt, Type THHN/THWN, 900C. Insulation color of conductors shall be as listed in Article 2.4, Color Codes
- D. Fillers: Fillers shall be non-hygroscopic and non-wicking.
- E. Binder: Core binder shall be corrugated polyester.
- F. Sheath: The metal sheath shall be galvanized steel or aluminum. The metal sheath shall be extruded onto the cable or applied longitudinally, then wrapped and welded. The sheath shall then be corrugated for greater flexibility.
- G. Jacketing: When PVC jacketing is required, the jacket shall be flame-retardant PVC with a temperature range of -400C to 900C.
- H. Equipment Grounding Conductor: The equipment ground wire shall be of the same construction as specified in 2.02.A and 2.02.B and be the same size as the current carrying conductors. The installation color shall be green.

2.03 FITTINGS:

- A. Fittings shall be UL listed and identified for such use with metal clad continuous corrugated sheath cable, with or without PVC jacketing, as is appropriate for the installation.

- B. Connectors shall be of steel or malleable iron and shall be a squeeze type clamp connector with a locknut for non-jacketed metal clad cable. Compression gland type connectors shall be used for jacketed metal clad cable.

2.04 COLOR CODES:

- A. Conductors are to be identified to preserve the following color code.

	208Y/120V System
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White

- B. Equipment Grounding: Conductors intended solely for equipment grounding purposes shall be Green in color. Conductors with White or Gray insulation shall be used only for the grounded neutral conductors.

PART 3 - EXECUTION

3.01 INSTALLATION – POWER AND LIGHTING SYSTEMS WIRING:

- A. Wiring shall be installed in compliance with the latest version of the National Electrical Code and other applicable codes and standards as indicated elsewhere in these specifications.
- B. Use of metal clad cable shall be permitted only for lighting, equipment, and receptacle branch circuits from a local junction box to the device and from device to device on the same circuit. Branch circuits from the panel to the local junction box shall be hard piped.
- C. Metal clad cable shall not be permitted in locations designated to be laboratories or hazardous Class I, II or III.
- D. Metal clad cable shall be permitted only for motor circuits where the motor being served is less than ½ HP and rated for 120V, single phase. Metal clad cable is not permitted for HVAC equipment and controls.
- E. Metal clad cable shall only be installed concealed within walls and above ceiling interstitial spaces. Where there is no ceiling interstitial space, metal clad cable may be installed exposed if called for on the Construction Drawings and in compliance with the installation requirements of this Section. Exposed metal clad cable shall have PVC jacketing.

- F. Bends in corrugated sheath metal clad cable shall be made so that the cable will not be damaged. The radius of the curve of the inner edge of a bend shall not be less than 7 times the diameter of the metallic sheath.
- G. Metal clad cable is not permitted to connect branch circuits to fume hoods, glove boxes, gas storage cabinets, or chemical storage cabinets.
- H. No metal clad cable shall be installed in ventilation ducts or plenums.
- I. Each branch circuit shall have its own neutral conductor from the branch circuit load back to the circuit breaker panelboard. Shared neutral conductors shall not be installed.
- J. All wiring shall be identified with permanent wire labels, using alphanumeric designations. Terminations and splices shall be identically labeled for the same wire (i.e. common conductors terminated in multiple locations). Wire labels shall agree with the circuit designations on the Construction Drawings.
- K. Identify conductors in outlets, pull boxes and similar locations where conductors are accessible with Thomas and Betts, Brady, or equal, printed plastic adhesive tapes to show circuit numbers. Wrap tapes at least two turns around conductor. Mark panel identification number with felt tip pen on Patrick and Co. Size 1, Type 11-172, Dennison Co., or equal, cloth or plastic tag and attach to entering conductors with nylon string.
- L. Conductors in Enclosures: Provide neat and workmanlike installation with conductors tied with T&B Ty-Rap, Virginia Plastics, or equal, nylon wire ties in terminal cabinets, gutters and similar locations.

3.02 SPLICES AND TERMINATIONS:

- A. The following installation methods shall be followed for termination of stranded conductors.
 - 1. Wire strands shall remain intact after the insulation is removed for the purpose of connecting the stranded wire to an approved lug or device.
 - 2. When landing wires at a terminal strip approved for stranded wire, all strands shall be enclosed within the terminal. (No shall be clipped off. No strands shall protrude from the terminal connector).
 - 3. When using lugs for termination, strands of the wire shall be contained in the barrel of the lug before crimping.
 - 4. Stranded wire shall be terminated only on devices and terminals approved for stranded wire. Number of wire shall not exceed 1 per termination. If the terminal is rated for more than one conductor, the number of wires shall not exceed 2.

5. In the case of screw type termination points, the wire is required to have an insulated locking fork or ring type lug approved for the wire size, crimped to the stripped conductor with an approved crimping tool for that particular lug.
 6. Only ring type insulated lugs shall be used for the instrument current transformer circuits.
- B. Splices at junction boxes shall be made with an approved, insulated, live spring type connector such as those manufactured by Scotchlock, 3M or Ideal.

3.03 FITTINGS:

- A. Fittings used for connecting metal clad cable to boxes, light fixtures or other equipment shall be UL listed and identified for such use.
- B. Cable preparation for installation of fittings shall follow manufacturer's instructions. The manufacturer's specialized tools shall be used for preparing cable ends for installation of fittings.
- C. The cable end shall be cut square to ensure flush seating of the cable into the fitting. Fitting securement screws shall be properly torqued. Cable ends shall be fitted with insulation bushings intended for the type of metal clad cable being installed.
- D. For jacketed metal clad cable, the outer jacket shall be removed to the length specified by the fitting manufacturer's instructions. Remove oils or solvent by-products from the outer jacket of the cable. The cable end shall be cut square to ensure flush seating of the cable into the fitting. The fitting gland nut shall be properly torqued to the manufacturer's specifications.

3.04 ARRANGEMENT AND SUPPORT:

- A. Where metal clad cables are exposed, run parallel with walls or structural elements. Vertical runs shall be plumb; horizontal runs level and parallel with structure, as appropriate. Groups shall be racked together neatly with both straight runs and bends parallel and uniformly spaced.
- B. Metal clad cables shall be securely fastened in place at intervals of not more than six feet, with suitable clamps or fasteners of approved type, and vertical conduits shall be properly supported to present a mechanically rigid and secure installation.
- C. Metal clad cable installed parallel to framing members, such as studs, joist, or rafters, shall be supported so that the nearest outside surface of the cable is not less than 1-1/4 inches (31 mm) from the nearest edge of the framing member. Where this distance cannot be maintained, the cable shall be protected by a steel plate, sleeve, or equivalent that is at least 1/16-inch thick.

- D. Maintain at least 6-inch clearance between metal clad cables and other piping systems. Maintain 12-inch (300 mm) clearance between metal clad cables and heat sources such as flues, steam pipes, and heating appliances.
- E. No metal clad cable shall be fastened to other conduits or pipes or installed so as to prevent the ready removal of other pipes or ducts for repairs.
- F. Individual metal clad cables hung from roof structure or structural ceiling shall be supported by split-ring hangers and wrought-iron hanger rods. Where 3 or more metal clad cables are suspended from the ceiling in parallel runs, use steel channels, Kindorf, Unistrut or equal, hung from 1/2-inch (13 mm) rods to support the conduits. The conduit on these channels shall be held in place with metal clad cable clamps designed for the particular channel that is used.
- G. Secure metal clad cable support racks to concrete walls and ceilings by means of cast-in-place anchors; die-cast, rustproof alloy expansion shields; or cast flush anchors. Wooden plugs, plastic inserts, or gunpowder driven inserts shall not be used as a base to secure conduit supports.
- H. Metal clad cable shall be supported immediately on each side of a bend and not more than 1 foot (300 mm) from an enclosure where a run of metal clad cable ends.
- I. Use of Cable Tray:
 - 1. The sum of the cross-sectional areas of cables shall not exceed the maximum allowable cable fill area allowed by NEC Tables 392.9, 392.9(E) and 392.9(F).
 - 2. Cables shall be installed in a single layer with a maintained spacing of not less than one cable diameter between cables.
 - 3. Ampacity of cables installed in cable tray shall meet the requirements of NEC 392.11.

3.05 INSPECTION AND TESTS:

- A. General: The electrical installation shall be inspected and tested to ensure safety to building occupants and operating personnel and conformity to Code authorities and Subcontract documents. Field tests shall be performed in conformance with the National Electrical Testing Association (NETA) Standards.
- B. All fittings and locknuts shall be re-examined for tightness.

END OF SECTION 26 0521

SECTION 26 0523 - LOW VOLTAGE OPEN WIRING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division 26, 27, 28 Basic Electrical Materials and Methods section, and is part of each Division 26, 27, 28 and Mechanical Sections 23 0913 and 23 0923 making reference to low voltage open wiring. The Contractor is held responsible to have become familiar with the provisions contained therein and in this section.

1.02 DESCRIPTION OF WORK:

- A. The extent of low voltage open wiring is indicated on the Drawings, schedules and contract documents.
- B. Types of low voltage open wiring specified in this section apply to the following:
 - 1. Access Control Systems
 - 2. Building Management Systems
 - 3. Smoke Montiroing Systems
 - 4. HVAC/Temperature Control Wiring
 - 5. Security Systems
- C. The Contractor shall bid the project as specified and shown on the Drawings and documents. The Drawings illustrate the work specified and are intended to agree in every respect with one another and with these specifications.
- D. All discrepancies that appear shall be brought to the attention of the Engineer for correction. No omission from any Drawing shall release the Contractor from furnishing equipment, materials or services called for by the specifications or other Drawings.
- E. Any deviation, alteration or substitution from the Drawings and specifications shall be fully documented by the Contractor and submitted as a voluntary alternate to the bid with the amount of deduct to the base bid specified.
- F. Approval of requests for substitution of products, processes or procedures other than those specified will be contingent upon submission of full acceptable documentation, and shall be the sole decision of the Engineer.
- G. Only substitutions approved by the Engineer in writing will be allowed.
- H. Products that are substituted must be electrically and mechanically interchangeable with the product specified.

- I. Samples of proposed substitutions shall be submitted to the Engineer prior to approval.
- J. Any substitutions without written approval are utilized at the risk of the Contractor.
- K. Unacceptable substitutions will be rejected without explanation or appeal.

1.03 CONTRACTORS:

- A. The Owner will contract only with Contractors having a successful history of sales, installation, service and support.
- B. All workmanship by the Contractor shall be of the highest quality.
- C. The Contractor shall be responsible for maintaining the cleanliness of all work areas as to not adversely affect other trades, Contractors or suppliers in the installation of their equipment.
- D. The Contractor shall be responsible for protecting any and all equipment and materials and finishes from damage during their installation process.

1.04 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of low voltage open wiring components of the types and as specified herein and on the Drawings, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC Articles 300, 640, 720, 725, 760, 770, 800, national, state and local codes as applicable to wiring methods, construction and installation of low voltage open wiring systems.
- C. NFPA Compliance: Comply with NFPA, national, state and local codes as applicable to wiring methods, construction and installation of low voltage open wiring systems.
- D. UL Compliance: Comply with applicable requirements of UL Standard 83 "Thermoplastic-Insulated Wires and Cables" and Standard 486A "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
- E. Provide wiring/cabling and connector products which are ETL or UL listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Standard Publications No. WC-5 and WC-30 pertaining to electrical type wires and cables.

- G. IEEE Compliance: Comply with applicable requirements pertaining to low voltage open wiring systems.

1.05 INSPECTION:

- A. Authorized representatives of the Owner and/or Engineer shall have access to the construction site at any reasonable time to inspect equipment, material, documentation and installation and to obtain information on work progress, quality and delivery.

1.06 WARRANTY:

- A. Contractor shall warranty equipment to be free from inherent defects in design, workmanship and material for a period of one (1) year from date of written contract completion and acceptance.
- B. Equipment shall function properly and continuously under all operating conditions required, specified or reasonably implied in the contract documents.
- C. All Drawings, specifications and other contract documents and the Owner's proprietary information shall be returned to the Engineer upon satisfactory completion of the contractual work.

1.07 SPECIAL CONDITIONS:

- A. Arrangements must be made by the Contractor to coordinate activities that may cause a disruption in the normal Owner activity.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Design and workmanship shall be in accordance with the requirements of the contract documents and subject to acceptance by the Engineer.
- B. Components shall be of the latest type and design manufactured for the intended use, and shall be laid out and installed such as to afford easy maintenance and/or replacement without major disassembly of adjacent components.
- C. All products shall be bid as specified.
- D. Any deviations from the products contained in the specification shall be noted and shall be bid as an alternate, with deducts specified.
- E. Any alternative products require 14 day prior approval from the Engineer.

2.02 CABLES:

- A. All cables shall be in accordance with the applicable system manufacturer's specifications.
- B. Plenum rated cables shall be used in plenum rated ceiling spaces.
- C. Factory "shorts", scrap or warehouse and prior job "clean-outs" (leftovers) will not be acceptable.
- D. The outer jacket of the cable shall be printed with the manufacturer's identification and required UL markings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Cables and wiring routed above an accessible ceiling may be run as "open wiring", unless otherwise noted.
- B. Cables routed above non-accessible ceiling areas or in open areas subject to abuse, shall be routed in conduit or other suitable raceway subject to the Engineer's approval.
- C. Cables and wiring routed through open ceiling commercial/ industrial spaces shall be routed in conduits, enclosed wireway or cable tray, unless otherwise noted.
- D. Whenever possible, primary cable routing paths shall follow the logical structure of the building. All cable servicing an area shall be routed parallel and perpendicular to building structure, following corridors and hallways. Diagonal runs are not acceptable.
- E. Where a wall must be breached, the cable shall pass through pre-established metal conduit sleeved openings.
- F. Corridor crossovers shall be kept to a minimum.
- G. For the purpose of this specification, all above ceiling space is to be considered "return air plenum" space, unless noted otherwise on drawings.
- H. All non-plenum rated cables must be routed in conduits through "return air plenum" spaces.
- I. It is the responsibility of the Contractor to verify "non-plenum" rating requirements.
- J. Cable that is run open above a suspended ceiling shall be supported by either a cable tray, channel or j-hooks.

- K. Cable shall be routed above the bottom of all metal framing such as floor joists or trusses for the next floor or roof above.
- L. Cables shall be neatly bunched, bundled and tied together and routed above the bottom of the joist with supports mounted from the bar joist or truss.
- M. Low voltage open wire cables shall not lay in the joist or on ductwork, piping and plumbing systems or on top of the lay-in ceiling tile.
- N. Cables shall not be supported from ductwork, piping, plumbing systems, ceiling tile and lighting fixture suspension wires or building structure.
- O. Low voltage open wiring shall not be routed in or through data/telecommunication or other cabling raceways, conduits, cable trays, sleeves, etc. The Contractor shall provide a dedicated raceway system for his system installation unless otherwise noted.
- P. All low voltage wiring exposed below the bottom of the joist line shall be enclosed in conduit or other approved raceway.
- Q. Maximum allowable spacing between cable/wiring supports shall be 48".
- R. Plenum rated cable ties and cable supports shall be utilized in all plenum rated spaces. Electrical tape is not acceptable as a cable tie, cable ties are not acceptable as a cable support.
- S. All cables shall be free of tension at both ends as well as over the length of the run.
- T. Cable ties and supports shall not pinch, bind, crimp or in any way cause physical or electrical characteristic damage to the cabling.
- U. Contractor shall assure that during and upon completion of the installation, all cables are free of kinks, sharp bends, twists, gouges, cuts or any other physical damage.
- V. Contractor shall patch and repair any holes, removals, adds or other changes to walls, ceilings or floors and paint to match.
- W. All cutting, patching and restoration to the original condition of walls, ceilings, floors, etc., shall be the responsibility of the Contractor unless otherwise noted.
- X. For those locations that cables pass through metal studs, the Contractor shall install a bushing or grommet in all metal studs to prevent damage to the cables.
- Y. Cables shall be routed and supported away from building structure and system components, minimum clearance 3".

3.02 SUBMITTALS:

A. Record Drawings:

1. The Contractor shall keep in the field and open to inspection, an accurate, current, progressive record of the actual installation of the low voltage open wiring system.
2. Upon completion of the work, the Contractor shall deliver marked prints showing the actual routing of cable runs and termination points.

B. Low Voltage Open Wiring System Documentation:

1. Include with specified system documentation equipment catalog cut sheets, manufacturer's specifications on the low voltage open wiring components and manufacturer's warranty statements.

END OF SECTION 26 0523

SECTION 26 0526 - GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical grounding work is indicated by Drawings and schedules.
- B. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- C. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS:

- A. Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.
- B. Ground Rods: Copper-clad steel, ¾" diameter x 10'-0" L.

- C. Exothermic welded connections: Provided in kit form as recommended by the manufacturer based on specific types, sizes and materials to be welded.
- D. Main Service Ground Bar: ¼" x 4" x 16" (minimal) solid copper. Minimum 16 double lug connections with stand offs and plexiglass cover. Cover to read "Main Service Ground Bar."
- E. Intersystem Ground Bar: ¼" x 4" x 16" (minimum), solid copper, minimum 16 double lug connections with stand offs and plexiglass cover. Cover to read "Intersystem Ground Bar."
- F. Ground Access Well:
 - 1. Non-vehicular Traffic Areas: 9" diameter x 10" diameter (minimum), HDPE, 350 PSF static load.
 - 2. Vehicle Traffic Areas: 12" diameter x 12" diameter (minimum). Schedule 80 PVC, cast iron lid, cast iron ring, 20,000 pound static load.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Ground all conduits, cabinets, meters, panels, fixtures and other exposed non-current carrying metal components of electrical equipment in accordance with all provisions of the National Electrical Code.
- B. Flexible connections to motors shall be jumpered with a No. 14 minimum green equipment grounding conductor, or per National Electrical Code Table 250-122.
- C. Install a green bonding jumper between the outlet box and the receptacle grounding terminal on all flush mounted receptacles.
- D. An insulated ground wire shall be installed in all feeder, branch circuit and lighting circuit raceways. Ground wire shall be sized in accordance with N.E.C. Article 250.
- E. Grounding bushings shall be utilized on each conduit which is not bonded to a grounded enclosure by means of properly installed conduit nuts, one on each side of the enclosure panel and properly tightened such as to cut through the panel paint and make bare metal to metal contact.
 - 1. Grounding bushings shall be utilized on each conduit in flush or recessed mounted panel and enclosure installed in a masonry wall/structure.

- F. Ground all step down transformers in accordance with N.E.C. Article 250-30 for Grounding Separately Derived Alternating Current Systems.
 - 1. The bonding jumper shall be directly connected to a grounding electrode.
 - 2. The transformer case shall be bonded to the grounding electrode conductor, but shall not be used as the grounding electrode.
 - 3. The grounding electrode conductor shall be protected within rigid metallic conduit.
- G. Install grounding bonding jumper across all building expansion joints, conduit, busway and cable tray expansion fittings.
- H. Install a building grounding electrode system in accordance with N.E.C. Article 250 and as required by the local inspecting authority.
 - 1. The building framework, metal siding, underground metal water piping, concrete encased electrode and other made electrodes shall be sufficiently bonded together.
 - 2. Connections to the metal underground water piping system shall be made on the line side of the water meter.
 - 3. Natural gas piping shall not be utilized as a ground electrode.
 - 4. It shall be the Contractor's responsibility to provide a grounding system acceptable to the local inspecting authority.
 - 5. Ground rods where indicated shall be installed with ground access well.
 - 6. See main service grounding details.
- I. Install an "Intersystem Ground Bar" and bonding conductor to the Main Distribution Panel/Service Entrance Panel per NEC 250.94.
 - 1. Size the bonding conductor per 250.66 or a minimum #2 AWG and maximum #4/0 average..
 - 2. See "Main Service Grounding Detail".
- J. The Contractor shall demonstrate by testing that the electrical service grounding system to earth resistance value is 10 Ohms or less, utilizing a "clamp-on" or 3 point fall of potential tester.
- K. The Contractor shall be able to demonstrate by test that the electrical service grounding system resistance from any grounded non-current carry conductor in the system to the electrical service entrance neutral/ground bonding conductor is less than 0.1 Ohms.

END SECTION 26 0526

SECTION 26 0533 - RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways specified herein.
 - 1. Section 26 0534 – Electrical Boxes and Fittings

1.02 DESCRIPTION OF WORK:

- A. Extent of raceway work is indicated by Drawings and schedules.
- B. Types of raceways specified in this section include the following:
 - 1. Electrical Metallic Tubing (EMT)
 - 2. Flexible Metal Conduit
 - 3. Intermediate Metal Conduit
 - 4. Liquid-Tight Flexible Metal Conduit
 - 5. Rigid Metal Conduit
 - 6. Rigid Non-Metallic Conduit

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three years.
- B. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
 - 2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled.
 - 3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.01 CONDUIT:

- A. All exposed interior conduit shall be full weight rigid steel or IMC except when specifically noted in these specifications or the accompanying drawings. Conduit shall be galvanized or sheradized inside and out.
- B. Branch circuit conduits in stud partitions, interior block walls, and when concealed above a ceiling or exposed above the bottom chord of bar joists may be electrical metallic tubing.
- C. Branch circuit conduits fed from one overcurrent protection device 100A or greater shall be full weight rigid steel or IMC or EMT.
- D. Feeder conduits in stud partitions, interior block walls, and when concealed above a ceiling or above the bottom chord of bar joists shall be EMT.
- E. Feeder conduits in open unfinished areas shall be EMT and routed above the bottom chord of bar joists or on "unistrut" conduit racks.
- F. Exposed conduits in unfinished areas, mechanical rooms, electrical equipment rooms and chases shall be full weight rigid steel or IMC or EMT as allowable above.
- G. Exposed exterior conduit, conduit in tunnels, conduit in exterior block walls, and conduit for 5kV or 15kV systems shall be full weight rigid galvanized steel.
- H. Conduit buried in concrete slab pours shall be full weight rigid galvanized steel or Carlon Schedule 80 PVC or Carlon Schedule 40 PVC.
- I. Conduit buried beneath building slabs and exterior below grade shall be full weight rigid galvanized steel or, Carlon Schedule 80 PVC or Carlon Schedule 40 PVC when Schedule 40 PVC is used, service conduits and other underground conduit shall only require 3" concrete envelope where called for on the Plan Drawings. All elbows and stub ups shall be rigid galvanized steel. All joints and terminations for PVC shall be made according to manufacturer's recommendations using "Carlon Solvent Weld Cement" to insure all joints are watertight.
- J. Conduit exiting building perimeter through footings or grade beams shall be full weight rigid galvanized steel for 10'-0" on either side of penetration and shall be protected with a minimum of 3" styrofoam top and bottom at exit point.
- K. Flexible galvanized steel conduit shall be used for "make-up" connections to rotating machinery (maximum 24"), equipment or flush luminaires. Flexible conduit in damp or wet locations shall be liquid tight.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Provide a rigid metal conduit system for all wiring except as may be specifically accepted elsewhere in the Specifications.
- B. Concrete encasement of feeders 400A and larger shall have red dye sprinkled on top during pour.
- C. Home runs from panels to first outlet box are shown as arrows. These runs may be installed either overhead or under the floor, unless specifically noted on the Drawings.
- D. Conduit shall be sized in accordance with the latest edition of the National Electrical Code; however, a minimum of 1/2" for flexible conduit must be maintained. All other conduits shall be 3/4" minimum, unless otherwise noted.
- E. Conduits concealed under floor slabs shall be 3/4" minimum, exterior below grade conduits shall be 1" minimum.
- F. All conduit buried beneath the slab, exterior underground and underground conduit ductbanks shall include an electrical warning tape installed during the backfill of the trench. Warning tape shall be a minimum of 12" below grade and a minimum of 6" above the conduit or ductbank encasement.
- G. No horizontal runs of conduit may be installed in masonry walls except by specific permission of the Engineer.
- H. Conduit shall be run exposed in the unfinished areas of the plant, basement, mechanical rooms, panel closets, mechanical spaces and elsewhere specifically noted on the drawings. Combined surface and concealed raceways in unfinished areas are not acceptable. Elsewhere, all work shall be concealed. Conduit and boxes in block or tile walls shall be installed in such a way as not to disfigure these walls.
- I. Exposed conduit work shall be kept as inconspicuous as possible and shall be laid out in a neat workmanlike manner, parallel and perpendicular to building steel, without runs diagonal to the building walls.
- J. Where continuous fluorescent fixtures are shown served by a single junction box, with wiring installed in fixture channel, such channels shall not be used for serving other outlets.

- K. Flush fixtures shall have branch conduit terminated in a junction box above ceiling, but accessible through ceiling opening and located at least 1'-0" away from the fixture. Not more than 6'-0" of 1/2" flexible steel conduit with Type THHN wire shall be used for connection between the junction box and the fixture housing.
- L. A 1/8" diameter nylon pull rope shall be installed in all empty conduits.
- M. All conduit shall be substantially supported by pipe straps or suitable clamps or hangers, at intervals not to exceed 8'-0", so attached to the structure of the building as to provide a substantial and rigid installation. Conduit straps for surface mounted conduit work shall be one-hole malleable with clamp backs. Joint use of hangers with heating and plumbing lines will not be permitted and conduits shall be installed above piping wherever possible.
- N. Install three spare 3/4" conduits from each flush panel to above lay-in ceiling in front of panel where possible.
- O. Conduit feeders or home runs shall be routed from first outlet box or junction box direct to appropriate panel. "Tangle" boxes or wireways shall not be installed adjacent to panel for the conveniences of terminating conduits.
- P. Pull boxes shall be installed on feeder runs as required, and shall be sheet steel with screw cover fronts. Feeder runs shall have individual pull boxes, such that adjacent raceway feeder cables are not combined in a common enclosure.
- Q. Where sleeves are required or shown on the Drawings through smoke or fire rated walls or floors, they shall be galvanized rigid conduit threaded in both ends with galvanized pipe caps, not bushings with inserts or blanks. Sleeves shall be located free of obstruction so that Erikson couplings can be added at a later time.
- R. The following pertains to all concrete encased duct banks. As soon as duct banks are poured, and before concrete sets, blow a Greenlee type piston through each conduit and leave a 1/8" nylon pull cord in each conduit.
- S. Conduits shall not be installed on top of joists or beams within the convolutions of the metal deck. All conduits shall be supported against the bottom of the top cord of the joist. No conduits shall be fastened to the bottom cord of joist.
- T. Conduit fittings such as LB's shall be as follows: 1.5" or smaller, shall be Form 8. All fittings 2" or larger Mogul LBNEC or LBD Series.

- U. Where prefabricated flexible wiring systems in flexible raceway are specified in lieu of rigid conduit for lighting systems, wiring harnesses shall be neatly routed parallel and perpendicular to the building steel in both finished and unfinished areas. Support bridles shall be galvanized steel and fastened in accordance with this Specification section. Routing of wiring harnesses shall also be in accordance with this specification section. Flexible wiring systems shall not be routed in concealed inaccessible areas.
- V. Long sweep elbows or appropriately sized pull boxes shall be used for all change of direction in communication conduit systems. LB's are not to be used.

END OF SECTION 26 0533

SECTION 26 0534 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to electrical wiring boxes and fittings specified herein.

1. NEC Article 314 – Outlet, Device, Pull and Junction Boxes

1.02 DESCRIPTION OF WORK:

- A. Types of electrical boxes and fittings specified in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Bushings
5. Locknuts
6. Knockout Closures

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- C. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s 051, 052 and Pub 250 pertaining to outlet and device boxes, covers and box supports.
- E. Federal Specification Compliance: Comply with applicable requirements of FS W-C 586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies and Entrance Caps".

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. Wiring device outlets for surface conduit work shall be "FS" (Appleton or Crouse-Hinds) series fittings and matching galvanized steel plates. Junction boxes for surface conduit work and exposed exterior conduit work shall be cast-threaded fittings with gasketed covers.
- B. Junction boxes for branch circuiting and located above the bottom chord of the joist may be pressed steel.
- C. Junction/pull boxes for feeders shall conform to NEC Article 314 as well as UL Standard 50 (cabinets and boxes). Sheet metal boxes approved for dry, interior, non-hazardous locations. Boxes installed in wet locations shall be NEMA 3R unless noted otherwise. Note, refer to Section IV for applications greater than 1000 Volts.
- D. Flush outlet boxes, junction and pull boxes, shall be pressed steel, galvanized or sherardized of size and shape required for the use and conduit terminals. Steel boxes designed for concrete installation shall be used where outlets, junction or pull boxes are cast in concrete.
- E. Section switch boxes shall not be used.
- F. Boxes for flush installation of power devices shall be 4" square, depth as required by code for the number of conductors, complete with 3/4" or 1" rectangular plaster rings, Steel City 52-C-14 or 52-C-15 or Raco 773 or 774. All boxes shall be installed flush in finished sections of building. Flush boxes shall be set back in wall not more than 1/8". Where conduits larger than 3/4" are used, 4-11/16" boxes with 1" plaster rings, Raco 839 shall be installed.
- G. All outlet boxes in walls with combustible material such as carpeting, shall have non-combustible box extensions.
- H. Contractor's attention is called to Box Fill Chart Table 314-16(a) of the National Electrical Code. This applies to all systems; that is, power, lighting, fire alarm, etc.
- I. Wall and ceiling lighting outlet boxes shall be fitted with boltless fixture studs and stud extensions as required.
- J. Lighting outlets on surface conduit work shall be pressed steel boxes unless cast hood integral with fixture is specified.

- K. All rigid and IMC nipples or conduit where they enter boxes shall be secured in place by double locknuts and bushings. All bushings on conduit 1" and larger shall be insulated bushings. All conduit shall be rigidly supported and clamped at intervals not to exceed 8'-0". Anchor bolts, where required, shall be of the lead wedge, or expansion type, firmly set.
- L. Rigid and IMC conduit fittings shall be threaded type three-piece couplings (Erikson). Threadless or setscrew couplings or connectors shall not be used.
- M. Thinwall couplings and connectors shall be steel setscrew type.
- N. Flexible metallic couplings and connectors shall be malleable iron or stamped steel fittings.
- O. Die-cast fittings shall not be used.
- P. Floor Boxes
 - 1. FB1: Multi-gang, multi-configuration floor box for power, data, and audiovisual services with 3/4" knockouts for power and 1-1/4" knockouts for data/audio visual, up to eight single-gang compartments, two duplex receptacle(s) as indicated, communications and audio visual requirements as indicated on the "EC" drawings, provide all device brackets, activation plates, gang boxes, and other accessories as required, coordinate cover requirements (tile, carpet, etc.) and color with the Architect and architectural drawings
 - a. Manufacturer:
 - 1. FSR FL-500P Series
 - 2. Legrand Evolution EFB8 Series
 - 3. Hubbell CFB11G Series.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The minimum size of outlet boxes, pull boxes and junction boxes shall be according to the National Electrical Code, Article 314.
- B. Do not install any boxes back-to-back. Do not install boxes closer together than 12" if outlets are in a common wall, but in different rooms.
- C. Wiring device outlets for surface conduit work shall be "FS" (Appleton or Crouse-Hinds) series fittings and matching plates.

- D. Install junction and pull boxes where indicated on the Drawings and in addition to those required to meet all codes or for easy pulling of wires and installation consistent with good workmanship. Boxes shall be galvanized, code gauge and size, with screw covers. See Section 314-28 of the National Electrical Code for size. Boxes shall be installed so that covers are readily accessible and adequate working clearance is maintained after completion of installation.
- E. All junction and pull boxes shall have galvanized, sherardized or cadmium plated blank covers installed before completion of the work.
- F. Carefully refer to Architectural Room Treatment Schedules for proper selection of boxes.
- G. Carefully refer to room dimensions and door swings on the Architectural Drawings for location of outlets. In the event of discrepancy with the Electrical Drawings, the Architectural Drawings shall govern. The Engineer/Architect reserves the right to move any outlet 6'-0" from scaled location on Drawing without any additional costs.
- H. Ceiling lighting fixture outlets shall be located for symmetrical installation of luminaires between beams, walls, breaks in ceilings, etc. Refer to Architectural Reflected Ceiling Plans for actual location of fixtures in grid ceilings.
- I. All knockouts opened and unused shall be closed with snap-in closers.
- J. Outlet heights given below or as shown on the Drawings are to the centerline of outlet box. In unfinished masonry walls, adjust height to top or bottom location in block and adjust location to the nearest corner of block (switch height shall never exceed 48" to the centerline and outlet height shall never be lower than 16" to the bottom of the box). Unless specifically noted otherwise on the Drawings, dimensions to floor shall be as follows:

Switch Height:	48" to centerline
Convenience Outlets:	18" to bottom of box or 48" to centerline as noted
Convenience Outlets:	6" to bottom of box above counters
Motor Control Stations:	48" to centerline
For outlet heights of wall bracket and of auxiliary systems and special outlets:	Refer to the respective paragraphs and to the Drawings

Horn/Strobe Light:	80" to bottom of box or 6" below ceiling to top of box (whichever is lower)
Pull Stations:	48" to centerline
Data/Tele Outlets:	18" to bottom of box
Wall Telephones: (Normal & Handicap)	See Section 27 0528 of these specifications
Television Outlet:	See drawings
Handicap Auto Door Opener Pushbuttons:	As directed by manufacturer

- K. Where more than one switch/receptacle is shown at a location, the switches/receptacles shall be set under a gang plate in an order appropriate to the location.
- L. Switches shall be installed not more than 6" from the doorjamb to the switch or first switch of a group of switches.

END OF SECTION 26 0534

SECTION 26 0574 – ARC FLASH HAZARD ANALYSIS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 26 – Electrical, apply to the work of this section.

1.02 DESCRIPTION:

- A. The Contractor shall provide an Arc Flash Hazard Analysis for the 3-phase electrical distribution system as shown and / or described on the one lines, panel schedules, electrical drawings and/or narrative scope including their 3-phase loads. It is the responsibility of the electrical contractor to obtain all information required to perform this study.
- B. The Arc Flash Hazard Analysis shall include the electrical equipment as detailed in this section and/or with the accompany drawings.
 - 1. All new 3-phase equipment as indicated on the drawings.
 - 2. All existing 3-phase equipment as indicated on the drawings.
 - 3. Additional points as quantified on the drawings.
 - a. In general, a point will be defined as an individually identified 3-phase piece of equipment to receive a label with it's associated line side feeder and overcurrent protective device information.
- C. The study will include the creation of Arc Flash Hazard Warning labels specific to each individually identified piece of equipment. These labels serve as a guide to technicians and others in the selection of properly rated Personal Protective Equipment (PPE) in cal/cm², when working near exposed energized equipment.
- D. The contractor is responsible for supplying lifts, ladders or any other required equipment necessary for electrical data collection survey.
- E. This contractor is required to be perform work in compliance with the owner safety policies and procedures.

1.03 REFERENCES:

- A. International Electrical Testing Association – NETA ATS latest Edition: Acceptance Testing Specifications, and/or NETA MTS latest Edition: Maintenance Testing Specifications
- B. National Fire Protection Association – NFPA
- C. ANSI/NFPA 70: National Electrical Code

- D. ANSI/NFPA 70B: Recommended Practice for Electrical Equipment Maintenance

1.04 CODES AND STANDARDS:

- A. Occupational Safety and Health Administration: OSHA 29 CFR 1910
Subpart S 1910.331-335
- B. National Fire Protection Association: NFPA 70E-2018
- C. Institute of Electrical and Electronic Engineers: IEEE 1584-2018, 141 (Red Book), 242 (Buff Book)
- D. American National Standards Institute: ANSI Z535.4

1.05 QUALIFICATIONS:

- A. The Arc Flash Analysis shall be prepared by an electrical engineer that is a licensed Professional Engineer in the state which the project resides.
- B. Contractor and Engineer performing the studies shall have completed a minimum of ten (10) such studies on facilities of similar size, scope.
- C. The Contractor shall employ licensed journeyman electrician(s) to perform data collection. Personnel performing the arc flash data collection shall be trained and experienced with apparatus and systems being evaluated. These individuals shall be capable of conducting the tasks of data collection in a safe manner and with complete knowledge of the hazards involved.

1.06 SUBMITTALS:

A. Qualifications Submittal:

1. Prior to commencing the study a sample study report, Warning and Danger labels, one line shall be submitted by the Registered Professional Engineer for approval.
2. Contractor & Engineer personal qualifications as per 1.05B.
3. Technical data sheet for the labels. Data sheet required for each label type included.

B. Study Submittal:

1. A Final Study Report as described in Section 3.02 shall be submitted to the Engineer/Owner. Provide the quantity of copies required, as stated in 3.03B.
2. The Contractor and Engineer performing the study shall schedule a meeting with the Engineer/Owner to present and review the contents of the Final Study Report.

PART 2 – PRODUCTS

2.01 ANALYSIS SOFTWARE:

- A. The study shall be performed utilizing the latest version of SKM Power Tools Software.

2.02 LABELS:

- A. The labels shall meet the following minimum specifications:
1. Material Type: White Polyester
 2. Finish: Glossy
 3. Adhesive: Permanent Rubber Based
 4. Regulatory Approval: UL969 Labeling and Marking Standard Recognized as part of printed system
 5. Thickness: Per ASTM D1000 Testing method; Substrate 0.0020", Adhesive 0.0020", Total (excluding liner) 0.0040".
 6. Adhesion strength per ASTM D 1000 (20 min/24 hour dwell):
 - a. Stainless Steel: 155/160 oz/in
 - b. Textured ABS: 55/54 oz/in
 - c. Polypropylene: 140/143 oz/in
 - d. Painted Enamel: 144/149 oz/in
 - e. Powder Coated Metal: 102/104 oz/in
 7. Performance Properties:
 - a. Long Term High Service Temperature; 30 days at 248F: No visible effect.
 - b. Long Term Low Service Temperature; 30 days at 40F; No Visible effect.
 - c. Humidity Resistance; 30 days at 100F/95% RH; No visible effect
 - d. UV Light Resistance; 30 days in UV Sunlighter 100; No visible effect
 - e. Weatherability; ASTM G155 Cycle 1 30 days in Venon Arc Weatherometer; No visible effect
 - f. Salt Fog Resistance; ASTM B 117, 30 days in 5% salt fog solution chamber; No visible effect
 - g. Abrasion Resistance; Taber Abraser, CS-10 grinding wheels, 250 r/arm (Fed Std. 191 A Method 5306); R6000 Halogen Free: Print Legible after 100 cycles.
 8. Label shall be the Brady Series B483 Series Labels or approved equal.
- B. The "WARNING" label shall be 4" x 4" (minimum size) (Orange, Black & White) polyester or vinyl thermal transfer labels able to withstand temperatures from -40°C to 120°C and comply with the NEC labeling requirements. (For polyester use Brady # THTL-161-483-1-WA).*

- C. The DANGER label shall be 4" x 4" (minimum size) (Red & White) polyester or vinyl thermal transfer labels able to withstand temperatures from -40°C to 120°C and comply with the NEC labeling requirements. (For polyester use Brady # THLEL-25-483-1-DA).*
- D. All polyester labels installed outdoors shall be covered with clear polyester overlayment with pressure sensitive acrylic adhesive to protect the colors from UV exposure. (Use Brady # Y544700 or 23816957-20).*

PART 3 – EXECUTION

3.01 REQUIREMENTS:

A. Equipment Naming:

- 1. Contractor shall follow the project one-lines and panelboard schedules for equipment naming standards. Unnamed equipment such as disconnects, starters, control panels, etc. shall carry the name of its' load. Examples for unnamed equipment:
 - a. Pump P-1 Disconnect: DISC (P-1)
 - b. Pump P-1 Starter: STR (P-1)
 - c. Pump P-1 Control Panel: CP (P-1)

B. Data Collection:

- 1. The contractor shall survey the electrical power distribution system as shown on the project one-line drawings and panelboard schedules for the purposes of recording and documenting all data required to complete this study.
- 2. The contractor shall provide the shop drawings submittals along with the Coordination Study Report provided under Spec Section 26 0573 and the latest project one-lines to their engineer as part of the data collection.
- 3. The contractor shall additionally provide all transformer impedances, HV or LV fuse information (manufacturer, type and size), conductor lengths between all devices (equipment) and if the conductors are copper or aluminum. Note: Conductor sizes will be required if different from the project one-lines.
- 4. Contractor shall provide any other information required by the engineer to complete this study.
- 5. The engineer shall utilize design one lines, panel schedules and equipment shop drawings, provided by the Contractor, to determine the section and position of the breaker with its corresponding load. The Contractor shall notify the engineer of any changes from as built conditions as they relate to information provided. Naming convention of each point within the program shall utilize one of the following methods:
 - a. The breaker/switch naming convention consisting of panel name and breaker/fuse corresponding load. (Ex: PP-A (BKR P-1)).

- b. The breaker/switch naming convention consisting of the panel breaker / fuse positions (number) in panels. (Ex: Panel PP, Section 3, Position 1,3,5 should be PNL PP (BKR 3-1,3,5)). The Contractor shall verify the breaker positions (as built) as part of the data collection. Design and shop drawing information alone are not acceptable for this convention.
6. The contractor shall provide the available 3-phase and SLG (single line to ground) fault current and X/R ratio from the utility at the utility metering point. (Note: This can be obtained from the Short Circuit Study provided under Spec Section 26 0573)

C. Arc Flash Analysis:

1. The Arc Flash Analysis shall be completed in accordance with the guidelines of NFPA 70E and IEEE 1584 for performing arc flash hazard calculations. Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable. Pertinent data, rationale employed and assumptions shall be provided with calculations.
2. Perform a comprehensive analysis of facility electrical systems for all 3-phase equipment 208V and higher. No single-phase equipment is required.
3. The Arc Flash Analysis shall consider operation during normal conditions including alternate operations such as emergency power conditions with motors off, and any other operating condition that could result in a maximum incident energy.
4. The minimum data block information (format) required by the Owner to be shown on the analysis one-lines shall be provided by the Contractor as described in 3.01D1.
5. Based on the results of the Arc Flash Hazard Analysis, warning labels shall be produced for each piece of equipment (bus, device, etc.) in accordance with ANSI Z535.4-2002. The warning labels shall list the "worst case" incident energy of the various operating conditions described above. Extra labels shall be produced for the following areas:
 - a. Bus Ducts: Count the total number of buss sections. Two labels (one for each side) shall be placed on the splice plates connecting the buss sections.
 - b. Motor Control Centers: Count total number of vertical sections present for each MCC. One label will be placed on each vertical section.
 - c. Main/Sub Distribution Panels: Count the total number of sections present for each panel. One label will be placed on each vertical section.
 - d. Substation Rack-out Breakers (Count total number of feeder breaker cubicles). Labels are also required on the rear of any cabinets which have removable covers or hinged doors.

D. One-Lines:

1. The information given below are lists of available information which shall be displayed, at a minimum, in the data blocks for components and shown on the Arc Flash one-lines.

Buses:

Component Name
Nominal Voltage
Maximum Available Fault Current
Maximum Incident Energy
& Corresponding Scenario

Motor:

Component Name
Qty of motors (when grouped)
Motor HP
Nominal Voltage
Full Load Amps

Cable:

Component Name
Qty Per Phase
CableSize
Conductor Type
Conductor Desc
Length
Duct/Conduit Material
Installation
Feeder Ampacity

Protective Device:

Component Name
Manufacturer
Frame/Model
Amps Interrupting Rating
Frame/Rating
Sensor/Trip
Plug
CT Ratio
Settings

2-Winder Transformer:

Component Name
Nominal kVA
FullLoad kVA
Pri Voltage
Sec Voltage
Impedance (%Z)

Transmission Line:

Component Name
Rpos Ohms/Length
Xpos Ohms/Length
Xc pos MOhms/Length
Length

Utility:

Component Name
Nominal Voltage
Available Fault Current 3P
Available Fault Current SLG

Generator:

Component Name
Rated kw
X"d

E. Arc Flash Hazard Labels:

1. The label layout shall conform to the Engineer/Owner's requirements and be approved by them prior to production.
2. The "WARNING" label where the incident energy is less than (40 cal/cm²) shall contain at a minimum the following information:
 - ARC FLASH AND SHOCK HAZARDS ARE PRESENT! APPROPRIATE PPE REQUIRED. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH.

- REFER TO NFPA 70E FOR REQUIRED PPE

- Worstcase Incident Energy@Working Distance
- Equip. Name
- Barricade Boundary
- Date of calculations
- Arc Flash Boundary
- Voltage
- Maximum Available Fault Current
- Name of Engineer that Performed the Study

3. The "DANGER" label where the incident energy is greater than or equal to 40 cal/cm² shall contain at a minimum the following information:

- ENERGIZED WORK PROHIBITED

- Worstcase Incident Energy@Working Distance
- Equip. Name
- Arc Flash Boundary
- Date of calculations
- Voltage
- Maximum Available Fault Current
- Name of Engineering that Performed the Study

3.02 FINAL STUDY REPORT:

- A. Supply a Comprehensive Report with analysis methodology, findings and recommendations:

1. A summary of all assumed components used in the analysis in spreadsheet format or shown on the one-line drawing. Other assumptions made in analysis that are separate from components shall also be shown on the one-lines.
2. A summary of all input data for utility source, equipment, protective devices, transformers and cables in spreadsheet format.
3. A summary of the Arc Flash Analysis in spreadsheet format which gives at a minimum, the equipment name, protective device, available fault current and incident energy level (cal/cm²) at each 3-phase piece of equipment (bus).
4. Overcurrent device coordination curves (TCC) including related section of the single-line from the Coordination Study.
5. The one-line drawings created from the data collected shall be separated to fit onto minimum of Match design document size. drawings and exported to AutoCAD format. The one-lines printed for the Final Study Report shall be on 11 x 17 sheets.
6. The Contractor shall supply (1) CD which includes a back-up copy of the studies software project file and all information listed above in items "a" through "e" in PDF format.

7. The Contractor shall provide a method for tracking future changes to the power distribution system and a cost per point or hourly fee for the maintenance of the assessment and a detailed listing of what is included in that cost. The intent is for the assessment to be able to updated/maintained as the electrical system changes.

3.03 OWNER REVIEW MEETING:

- A. This review meeting shall be scheduled with the Owner at the Owner's location.(PROVIDE OWNER CONTACT INFORMATION)].
- B. The contractor / electrical engineer shall meet with the Owner to explain the Study Report (3.02). Supply one (1) copy of the Final Study Report at the review meeting during which the electrical engineer shall review all sections of the report in detail. With the Final Study Report, the contractor / electrical engineer shall supply two (2) sets of drawings of the electrical one-lines exported to AutoCAD. These may be used by the Owner to track future changes to the distribution system. [REMOVE 3.03 IF OWNER INFORMATION IS NOT AVAILABEL OR MEETING IS NOT REQUIRED]

3.04 LABEL INSTALLATION:

- A. The contractor shall install all labels on equipment based on the analysis prior to the owner review meeting. The label installation method shall match the label manufacturers recommended practices. Surface preparation: For dusty surfaces, wipe down with cloth towel prior to installing label. Labels should always be applied with firm, even pressure starting at one side of the label and working across the surface of the label with multiple passes. This ensures that the entire adhesive has good contact with the surface. Full adhesion strength will be reached after 24 hours.
- B. For equipment that is located outside, the contractor shall install an additional clear laminate to protect the label from UV. Labels should not be installed until temperatures are 45°F or higher.
- C. Contractor shall notify the engineer when the labels have been installed. The engineering firm that performed the arc flash study shall provide field verification that they have been installed on the proper equipment. (Field verification can be conducted at the time of the Owner Review Meeting). If labels are found to be installed improperly, the contractor shall review all label locations and replace any misapplied labels. The owner shall not incur any additional costs as a result of misapplied labels.

END OF SECTION 26 0574

SECTION 26 2415 – DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of distribution panelboard work is indicated by Drawings and schedules.
- B. Types of distribution panelboards specified in this section include molded case circuit breaker panelboards.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards, of types, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of panelboards.
- C. UL Compliance: Comply with applicable requirements of Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", and Std 67, "Panelboard". Provide panelboards and components which are UL-listed and labeled.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to panelboards.
- E. ANSI Compliance: Comply with applicable requirements of ANSI standards pertaining to panelboard assemblies.
- F. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub No. PB1, "Panelboards" and SG3, "Low Voltage Power Circuit Breakers" pertaining to panelboard assemblies.

1.04 WARRANTY:

- A. The low voltage panelboards shall be warranted for a period of one year after the date of acceptance by the Owner. Upon notice from the Owner, the supplier shall remedy all such defects at his own expense at a time convenient to the Owner.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on panelboards including, but not limited to, voltages, number of phases, frequencies, and short-circuit and continuous current ratings. Provide application data for main and branch circuit breakers, sections, main buses, and basic insulation levels.
- B. Shop Drawings: Submit layout drawings of panelboards showing accurately scaled basic equipment sections including auxiliary compartments, section components, and combination sections.

PART 2 - PRODUCTS

2.01 MAIN DISTRIBUTION PANELS:

- A. Furnish and install main distribution panel low voltage power style panelboard(s). Main distribution panel(s) shall consist of the required number of vertical sections bolted together to form one rigid switchgear with service entrance equipment nameplate.
- B. Panelboards shall be not more than 92" high. Panelboards shall include all protective devices and equipment indicated.
- C. Incoming and distribution sections shall be bussed with full capacity, three-phase, three-wire bus, rating as indicated on the drawings. Tapered bus sections are not acceptable. Switchboards shall be designed for 120/208 Volt, three-phase, four-wire, sixty-cycle service.
- D. The bus shall be tin plated copper or electrical grade aluminum of sufficient size to limit the temperature rise to 65°C above a 40°C ambient. If derating due to higher ambient temperatures is required, it shall be factored into the ampacity sizing of the bus. All bus ratings shall be based on UL test. The bus shall be braced for 65,000 Amperes (RMS Symmetrical) and supported to withstand mechanical forces exerted during short circuit conditions when directly connected to a power source having the indicated available short circuit current.
- E. Provide a full capacity 100% rated neutral bus where a neutral is indicated on the drawings. Neutral bus shall be isolated from the ground, except on the line side of the main switch. The panelboard shall be service entrance rated.
- F. A copper ground bus shall extend the entire length of the panelboard on each side of the circuit breaker connections and shall be firmly secured.
- G. Panelboard shall include all protective devices and equipment as listed on the drawings with necessary interconnection, instrumentation and control wiring.
- H. Enclosure shall be NEMA 1, unless otherwise noted on the drawings.

- I. Panelboard shall require front access only, and shall be a minimum 6-1/2" deep.
- J. All panelboards shall be set on a 3-1/2" high concrete pad extending 2-1/2" beyond all accessible sides with 45% degree chamfered edges.
- K. Panelboards shall be as manufactured by Square D I-Line, or equal by Siemens, Eaton or General Electric.

2.02 CIRCUIT BREAKERS:

- A. Furnish and install the circuit breakers of the size, type, number and rating as indicated.
- B. The main circuit breaker shall be rated for 80% of the current rating.
- C. The main circuit breaker shall be a true RMS sensing solid-state tripped system consisting of three current sensors, solid-state trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. All elements of the solid-state trip device shall be of the sealed potentiometer type providing continuous stepless current pick-up in percentage of current sensor primary rating and time delay adjustments. Trip units shall be insensitive to temperature in a 40°C ambient.
- D. The following individually adjustable solid-state elements shall be provided as an integral part of the solid-state trip device where indicated on the drawings:
 - 1. All breakers shall have long delay current pick-up (0.5 to 1.25 times sensor rating). Long delay time (4 to 36 seconds at 6 times sensor rating).
 - 2. All circuit breakers shall have short delay pickup (2 to 10 times sensor rating) and short delay time (0.18 to 0.5 seconds at 2.5 times short delay pick-up).
 - 3. All circuit breakers shall have an adjustable instantaneous pick up (10 to 30 times sensor rating).
 - 4. Breakers shall have ground fault current pick-up approximately 20% to 80% of sensor rating but not exceeding 1200 amperes and ground fault time (0.22 to 0.5 seconds).
 - 5. Provide resettable operation indicators for ground, overload and short circuit functions.
- E. When the adjustable instantaneous setting is omitted, the trip unit shall be provided with a discriminator or making-current release circuit to prevent closing the circuit breaker on a faulted system. The circuit shall be armed for approximately eight-cycles and shall operate for all fault levels above 11 times the ampere value of the sensor.

- F. The system shall be a UL listed current limiting/series combination short circuit interrupting scheme which allows 65 kAIC RMS at rated voltage at the MDP or as indicated otherwise on the drawings and shall protect all down stream breakers within their AIC rating. Panels shall be UL labeled to indicate the UL listing as part of an approved series combination scheme. Submit complete short circuit interrupting information and calculations with mark-up shop drawings.
- G. Service entrance main circuit breakers shall be Square D Power Pact with Micrologic, or equal by General Electric, Eaton or Siemens.

2.03 INSTRUMENTATION:

- A. A 0.2% accuracy solid state power meters with corresponding accuracy current and potential transformers as indicated on the Drawings. Transformers shall have mechanical ratings equal to the momentary ratings of the interrupter switches and shall be insulated for the full voltage rating of the switchgear. Potential transformers shall be equipped with current limiting fuses. Furnish six spare fuses. Provide solid-state power monitor/meter units on the main distribution panel, where indicated on the Drawings, and as specified elsewhere in these Specifications.
- B. Provide a separate customer metering compartment with front hinged door and include the following:
 - 1. Potential transformers with primary and secondary fuses with disconnecting means.
 - 2. Power metering (e.g., voltmeters, ammeters, power factor meters, solid-state power meters, etc.).
- C. Small wiring, necessary fuse blocks and terminal blocks within the switchgear shall be furnished as required. Control components, such as control transformers, fuse blocks, relays, etc., shall be suitably marked for identification where mounted on the switchgear corresponding to appropriate designations on manufacturer's wiring diagrams. All groups of control wires leaving the switchgear shall be provided with terminal blocks. Control wiring and control power wiring shall be properly identified at both ends of every termination with permanent wire number tags corresponding to the shop drawings. Provide wire markers at each end of all control wiring.

2.04 NAMEPLATES:

- A. All panelboards and feeder devices shall be complete with nameplates. The switchboard and panelboard nameplate shall include the panel name and the location the panel is fed from. Example: DP-XX (FED FROM MDP-XX).
- B. Lettering shall include name of equipment, the specific unit number, and any reference to "on" - "off" or other instructions that are applicable.

- C. Nameplates shall be laminated phenolic with a white surface and black core. Use 1/16" thick material for plates up to 2" x 4"; for larger sizes, use 1/8" thick material.
- D. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4" minimum height letters which occupy four to the inch. Increase letter size to 3/4" on the largest plates.

PART 3 - EXECUTION

3.01 BONDING AND GROUNDING:

- A. The main panel shall be the only panel where the panel neutral bar is bonded to the panel enclosure. All other neutral bars shall be isolated from the panel enclosures.
- B. Grounding bars shall be installed in all panels and shall be securely bonded to the panel enclosure. Identify bar with green marking. Do not bond any green wire to any white wire at any point except at the main panel. Reference N.E.C. 70 Article 384-27.

3.02 CONTRACTOR INSTALLATION:

- A. Contractor must examine areas and conditions under which switchgear and components are to be installed, and notify Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Install switchgear as indicated, in accordance with manufacturer's written instructions, with recognized industry practices: complying with applicable requirements of NEC, NEMA's Standard PB 2.1, and NECA's "Standard of Installation".
- C. Coordinate with other work including electrical cabling/wiring work, as necessary to interface installation of switchgear with other work.
- D. Distribution panelboards shall be set on a 3-1/2" high concrete pad extending 2-1/2" beyond all accessible sides with 45% degree chamfered edges.
- E. Tighten connectors and terminals, providing screws, bolts and Bellville washers, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- F. Install fuses in panelboard where required.
- G. Install circuit breakers in panelboard where required.

- H. Install power meter devices in panelboard.
- I. Adjust operating mechanisms for free mechanical movement.
- J. Install power monitoring network cabling.
- K. Touch-up scratched or marred surfaces to match original finish.
- L. Install spare fuse cabinet.
- M. Provide equipment grounding connections for switchgear as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- N. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
- O. Prior to energization of switchgear, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- P. Prior to energization, check switchgear for electrical continuity of circuits, and for short circuits.
- Q. Subsequent to wire and cable hook-ups, energize switchgear and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 2415

SECTION 26 2417 – PANELBOARDS (RECEPTACLE PANELS 120-208V ONLY)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of panelboard, load-center and enclosure work is indicated by Drawings and schedules.
- B. Types of panelboards and enclosures in this section include the following:
 - 1. Lighting and Receptacle Panelboards
- C. Refer to other Division-26 sections for cable/wire, connectors, and electrical raceway work required in conjunction with panelboards and enclosures.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC requirements pertaining to installation of wiring and equipment in hazardous locations.
- C. UL Compliance: Comply with applicable requirements of STd. No. 67, "Electric Panelboards", and Stds. No.'s 50, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide units which are UL-listed and labeled.
- D. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL marks which indicates that special type of use/application.
- E. NEMA Compliance: Comply with NEMA Stds. Pub/No. 250, "Enclosures for Electrical equipment (1000 Volts Maximum)", Pub/No. PB1, "Panelboards", and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".
- F. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

- G. Each panelboard as a complete unit shall have a short circuit rating equal to greater than the rating indicated on drawings. Where series ratings with main breaker and/or upstream devices are employed, the panel shall include a prominently displayed label indicating UL listed series ratings and state "Caution – Series Combination System Rated _____Amperes Identified Replacement Components Required".

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on panelboards.

PART 2 - PRODUCTS

2.01 PANELBOARDS:

- A. Furnish and install panelboards mounted in enclosing cabinets on which shall be mounted equipment as shown on the Drawings, specified or required.
- B. Panelboards shall be dead front type and equipped with thermal magnetic molded case circuit breaker units, as indicated.
- C. Cabinets shall be galvanized, code gauge, sheet steel complete with flush or surface type trim as indicated and shall be a minimum of 17" wide and 5-3/4" deep.
- D. Provide adequate wiring and gutter space and a means for circuit identification. Provide a glazed, typewritten circuit directory.
- E. Breakers shall be common trip, bolt type, rated 10,000 amperes interrupting capacity.
- F. Circuit breakers shall be rated for protection of load designated to serve:

<u>Load Type</u>	<u>Circuit Breaker Rating</u>
Heating, AC, Refrigeration, Motor	HACR
Fluorescent, HID Lighting	HID
Panel Light Switching	Switch Duty
Dimmers, Neon, Transformer	High Magnetic IN Rush

- G. Panelboards shall be Square D Type NQ, or equal by Siemens, General Electric, or Eaton.
- H. Panelboards shall be designed for 120/208 volts, three-phase, four-wire service.
- I. Provide flush doors with lock and keys. Provide two keys for each panel. All locks shall be keyed alike.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Panels shall be mounted with the top of the cabinet 6'-0" above floor level.
- B. All panels shall be identified with embossed plastic nameplates.
- C. Bonding and Grounding: The main panel shall be the only panel where the panel neutral bar is bonded to the panel enclosure. All other neutral bars shall be isolated from the panel enclosures.
- D. Grounding bars shall be installed in all panels and shall be securely bonded to the panel enclosure. Identify bar with green marking. Do not bond any green wire to any white wire at any point except at the main panel.

END OF SECTION 26 2417

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to wiring devices specified herein.

1.02 DESCRIPTION OF WORK:

- A. Types of electrical wiring devices specified in this section include the following:

1. Switches
2. Receptacles
3. Ground-Fault Circuit Interrupters
4. Wall Plates
5. Lighting Control Devices
6. Emergency lighting relay control devices
7. Lighting/Device Space Control System

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring device, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- C. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL-listed and labeled.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems".
- E. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps", and WD 5, "Specific-Purpose Wiring Devices".
- F. FS Compliance: Comply with FS W-C-596 (Series) and FS W-S-896 (Series) pertaining to electrical power connectors and toggle switches.

PART 2 - PRODUCTS

2.01 DEVICE FINISH:

- A. The color finish of all devices and plates shall be selected by the Architect. The specification is based on gray devices. The Contractor shall verify with the Architect the exact color during submittal process prior to ordering equipment.

2.02 SWITCHES:

- A. Wall switches are listed in the single pole configuration. Three-way, four-way, double-pole, etc. shall be of the same series. All switches shall be of the same type throughout the building and shall be the product of one manufacturer, unless specifically noted otherwise.
- B. Switches shall be industrial heavy duty specification grade, 120/277V rated, nylon toggle, color coded housing (Red = 20A), side and back wired, brass binding screws.
- C. The 20A single pole industrial heavy duty specification grade switches shall be:
- | | | |
|----|----------------|-------------|
| 1. | Cooper | 2221GY |
| 2. | Hubbell | HBL1221GRY |
| 3. | Leviton | 1221-2GY |
| 4. | Pass & Seymour | PS20AC1-GRY |
- D. The 20A single pole industrial heavy duty specification grade pilot light switch (illuminated in "ON" position) shall be:
- | | | |
|----|----------------|-----------------|
| 1. | Cooper | 2221PL |
| 2. | Hubbell | HBL1221PL |
| 3. | Leviton | 1221-(7)PL* |
| 4. | Pass & Seymour | PS20AC1-RPL(7)* |
- * (7) indicates 277V rated unit
- E. The 20A single pole industrial heavy duty specification grade lighted handle switch (illuminated in "OFF" position) shall be:
- | | | |
|----|----------------|-------------|
| 1. | Cooper | 2221 LTW |
| 2. | Hubbell | HBL1221IL |
| 3. | Leviton | 1221-(7)L* |
| 4. | Pass & Seymour | PS20AC1-ISL |
- * (7) indicates 277V rated unit
- F. Locking switches shall be Pass & Seymour PS20AC1-L Series only. No other brands will be accepted.

2.03 RECEPTACLES:

- A. All receptacles shall be of the product of one manufacturer throughout the building.
- B. Duplex receptacles shall be industrial heavy duty specification grade 20A, side and back wired, solid brass mounting strap, fiberglass reinforced nylon base, high impact chemical resistant nylon face.
- C. Tamper resistant duplex receptacles shall have spring loaded mechanical shutter system, 20A, side and back wired, solid brass mounting strap, high impact chemical resistant nylon face, automatic ground clip. The catalog numbers for the 20A receptacle are as follows:
 - 1. Pass & Seymour TR5362-GRY
 - 2. Or approved equal by Cooper, Hubbell or Leviton
- D. The catalog numbers for 20A duplex receptacles are as follows:
 - 1. Cooper 5362GY
 - 2. Hubbell HBL5352GY
 - 3. Leviton 5362GY
 - 4. Pass & Seymour 5362-AGRY
- E. USB Charging Receptacles shall include two 20A receptacles along with two USB charging ports. The device shall include a green LED to indicate the USB power is available. The USB power shall be rated at 5 Amp 5 Volt DC. There shall be one Type A and one Type C USB port. Battery charging shall comply with BC1.2 and compatible with USB 1.1/2.0/3.0 devices, including Apple products. The device shall include a USB port door which switches off USB power when door is closed. Device shall be side wired.
 - 1. Hubbell USB20AC5GY
 - 2. Or approved equal by Pass & Seymour, Cooper, or Leviton
- F. Permanently marked switch controlled receptacles shall include the NEC 406.3(E) symbol on the face of the receptacle next to each receptacle. Both receptacles shall be controlled. The device shall be 20A, side and back wired solid brass mounting strap, high impact chemical resistance nylon face, automatic ground clip, and tamper resistance. The device face shall be green. The catalog numbers for the permanently marked switch controlled receptacles are as follows:
 - 1. Hubbell BR20C2GNTR
 - 2. Or approved equal by Pass & Seymour, Cooper, or Leviton

- G. The surge protected duplex receptacle shall include internal MOVs providing 240 joules at 15kA peak of surge protection for each mode. The device shall include an indicator light and alarm with silence mode. The device shall meet UL1449 4th Edition requirements. The device shall include two 20A receptacles. The device face shall be blue. The catalog numbers for the permanently marked switch controlled receptacles are as follows:

1. Hubbell HBL5362SA
2. Or approved equal by Pass & Seymour, Cooper, or Leviton

2.04 GFCI DEVICES:

- A. Ground fault circuit interrupter devices shall have a trip level of 4 to 6 mA in no greater than 0.025 sec. The device shall be rated at 20A, 120V (+10%, -15%), 60 Hz, and 2 kAIC. The device shall have a trip indicator.

- B. Duplex receptacle GFI devices shall be heavy duty industrial grade, 20A, back and side wired, nylon body, solid brass mounting strap and contacts, auto-ground clip. The catalog numbers for the 20A receptacle are as follows:

1. Hubbell GF5362GYA
2. Pass & Seymour 2095-GRY
3. Or approved equal by: Cooper or Leviton

- C. Duplex receptacle GFI tamper resistant devices shall be heavy duty industrial grade, 20A, back and side wired, nylon body, solid brass mounting strap and contacts, auto-ground clip. The catalog numbers for the 20A receptacle are as follows:

1. Pass & Seymour 2095-TRGRY
2. Or approved equal by: Cooper, Hubbell or Leviton

- D. Duplex receptacle GFI weather resistant, tamper resistant (wet location) devices shall be heavy duty industrial grade, 20A, back and side wired, nylon body, solid brass mounting strap and contacts, auto-ground clip. The catalog numbers for the 20A receptacle are as follows:

1. Pass & Seymour 2095-TRWRGRY
2. Or approved equal by: Cooper, Hubbell or Leviton

2.05 PLATES:

- A. Plates for flush devices shall be brushed stainless steel, Hubbell S1 series or equal by listed manufacturers. Plates for devices on surface outlets and flush outlets in unfinished areas shall be galvanized steel wiring device covers. Gang plates shall be installed on gang installation devices. Blank covers for pull and junction boxes shall be galvanized, or smooth satin stainless steel in finished areas.

- B. Where duplex receptacles are protected by GFCI receptacles or circuit breaker, plates shall be engraved "G.F.C.I. PROTECTED", matching stainless or galvanized steel per specifications.
- C. Where duplex receptacles are automatically controlled or that incorporate features that remove power from the outlet for the purpose of energy management or building automation, device faceplate shall be marked with symbol defined in NEC 406.3(E).
- D. Weatherproof switch covers shall be gray cast toggle plates with gasket on an FS Box:
 - 1. Appleton WCT1
 - 2. Pass & Seymour CA1-GL
 - 3. Steel City SW1-C
- E. Weatherproof coverplates shall be "IN-USE" rated, manufactured with UV stabilized high impact clear polycarbonate. Coverplate shall be vertical or horizontal mount and accept duplex receptacles, switches, GFI mounting. Cover shall allow padlocking. Coverplate shall include gasketing. Weatherproof coverplate shall be Red Dot CKNM (single gang), 2CKNM (double gang) or approved equal by Hubbell or Taymac.

2.06 LIGHTING CONTROL DEVICES

- A. In wall timer lighting control switch, with automatic shut-off, adjustable timed interval, 120/277V, with off warning flicker, 150W max.
 - 1. Hubbell TD300
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper
- B. In wall automatic lighting control switch, 180 degree coverage, 900 sq.ft. coverage, passive infrared and micro phonics detection, adjustable time delay, single pole, 120/277V
 - 1. Hubbell LHMTS 1
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper

- C. Wall / ceiling mounted lighting control sensor, dual technology, ultrasonic / infrared, 1600 sq.ft. coverage.
 - 1. Hubbell LO DT
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper

- D. Ceiling mounted lighting control sensor, dual technology, ultrasonic / infrared, 2000 sq.ft. coverage.
 - 1. Hubbell OMNI DT 2000
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper

- E. Lighting control power packs, 24VDC, 150mA output, 120/277V
 - 1. Hubbell UVPP
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper

- F. Lighting control power pack with auxiliary relay device
 - 1. Hubbell MPSA
 - 2. Copper Controls
 - 3. Greengate
 - 4. Hubbell-Automation
 - 5. Leviton
 - 6. Lithonia Lighting Control
 - 7. Watt Stopper

2.07 LIGHTING/DEVICE SPACE CONTROL SYSTEM

- A. The lighting/device space control system shall consist of a stand-alone room system with devices that control the luminaires and indicated receptacles within the space. The individual devices shall be connected and communicates on an intelligent network system within the building; all space systems connected as one complete system. The lighting/device space control system shall control one (1) circuit of lighting and one (1) circuit of receptacle control (where present) within the space. The system shall be capable of multiple control locations. The system shall consist of:
1. Manual controls (switch and dimming)
 2. Dimming controls (0-10v)
 3. Ceiling mounted occupancy sensors
 4. Wall / corner mounted occupancy sensors
 5. Ceiling mounted day light harvesting sensor
 6. Power pack with dimming control (0-10V)
 7. Power pack
 8. Power pack with auxiliary relay
 9. Vacancy mode lighting control for turning lighting/receptacles off, and manual control for turning lighting on.
- B. Manufacturers:
1. Hubbell-Automation NX series
 2. Eaton Controls
 3. Greengate
 4. Leviton
 5. Acuity Lighting Control
 6. Watt Stopper

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Where more than one switch/receptacle is shown at a location, switches/receptacles shall be set under a gang plate in an order appropriate to the location.
- B. Switch and receptacle mounting heights are indicated in Section 26 0534.
- C. All outlets shown not receiving a specific outlet or connection shall be supplied with a blank plate to match other device plates in area.
- D. Devices shall be installed utilizing pigtail connections with leads of no less than 6".

- E. Device circuit number and source panel shall be indicated on all outlets. Indication shall be legible print and made with permanent ink on the back side of the faceplate. Indication on the front side of the faceplate shall be a type written or machine printed clear label with black lettering, 10 point minimum size, Helvetica style font.
- F. Tamper resistant devices shall be installed in all locations are described in N.E.C. 406.12 or as indicated on drawings.
- G. GFI type and GFI tamper open resistant type receptacles shall be installed indoors only.
- H. GFI weather resistant, tamper resistant receptacles shall be installed outdoors or other locations considered damp or wet locations per N.E.C.

3.03 LIGHTING/DEVICE SPACE CONTROL:

- A. Install all equipment in accordance with the manufacturer's installation instructions, specific guidelines, and submittal documents.
- B. The system manufacturer shall provide a factory authorized field engineer to the project site after the installation has been completed and prior to the system energization for the purpose of testing and adjustment of the system. Factory field engineer shall test and verify all system functions and ensure proper operations of the system components in accordance with the specifications and on-site conditions. Contractor shall coordinate with the factory onsite programming, testing, and training two weeks prior to requested time.
- C. After system testing, adjustment, and programming is completed, the factory authorized field engineer shall provide four hours of training to the owner for operation, maintenance, and programming of the system.

END OF SECTION 26 2726

SECTION 26 2813 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.
- B. Section 26 2813 – Overcurrent Protective Devices.

1.02 DESCRIPTION OF WORK:

- A. Extent of overcurrent protective device work is indicated by Drawings and schedules.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of overcurrent protective devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of overcurrent protective devices.
- C. UL Compliance: Comply with applicable requirements of UL 489, "Molded-Case Circuit Breakers and Circuit-Breaker enclosures", and UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are UL-listed and labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. AB 1, AB 2 and SG 3 pertaining to molded-case and low-voltage power type circuit breakers.
- E. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 pertaining to low-voltage cartridge fuses.
- F. FS Compliance: Comply with Federal Specifications W-C-375B/GEN pertaining to molded-case circuit breakers.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Low voltage fuses shall be as manufactured by Bussmann, Mersen or Littelfuse. All fuses zero to 600-Amps shall be as follows unless otherwise noted on the Drawings:
 - 1. **CLASS "RK-5 / RK-1"**
 - a. Zero to 90-Amps dual element, time delay Class RK-5; Bussmann FRN-R/FRS-R, Mersen TR-R/TRS-R or Littelfuse FLN/R-FLS/R.
 - b. 100 to 600-Amps dual element, time delay, Class RK-1; Bussmann LPN-RK/LPS-RK, Mersen A2D-R A6D-R or Littelfuse LLN-RK/LLS-RK.
 - 2. **CLASS "L"**
 - a. Above 600-Amps time delay, Class L; Bussmann KRP-C, Mersen A4BY or Littelfuse KLP-C.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Furnish the Owner three spare fuses of each type and rating of sizes installed upon completion of the project.
- B. Furnish and install a 16-gauge sheet metal enclosure with hinged cover of sufficient size to house the spare fuses. Mount the enclosure near the Main Distribution Panel.

END OF SECTION 26 2813

SECTION 26 2816 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials and Methods sections, apply to work of this section.
- B. Section 26 2813 – Overcurrent Protective Devices.

1.02 DESCRIPTION OF WORK:

- A. Extent of circuit and motor disconnect switch work is indicated by Drawings and schedules.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- C. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide circuit and motor disconnect switches which have been UL-listed and labeled.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std's Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000-Volts Maximum).

PART 2 - PRODUCTS

2.01 SWITCHES:

- A. Switches shall be heavy duty as manufactured by Square D Company, Type HD, or Engineer approved equal by General Electric, Siemens, or Cutler-Hammer, and shall have the capability to be locked in either the "ON" or "OFF" positions.
- B. All switches shall be fused or non-fused, as indicated with quick-make, quick-break mechanism, full cover interlock, horsepower rated and enclosed in a NEMA 1 enclosure unless otherwise noted on the Drawings or herein the Specifications.
- C. All switches shall be sized to accommodate overcurrent protective devices as specified in Section 26 2813.

- D. Switches shall have rejection type fuse clips to accommodate Type R fuses only.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Furnish and install all switches and fuses as shown on the Drawings, specified or required.
- B. Each disconnecting means required by this standard for motors and appliances, and each service, feeder, or branch circuit at the point where it originates, shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident.
- C. All disconnects shall be identified with embossed plastic nameplates. The nameplate shall include the panel name and the location the panel is fed from. Example: DS-XX (FED FROM SDP-XX). See Section 26 0500 Electrical General Provisions for the nameplate specification.

END OF SECTION 26 2816

SECTION 26 2914 - POWER EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electric Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Furnish and install all conduit, wiring, connections, starters, safety switches, fuses, etc.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of motor starters, of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of motor starters.
- C. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces".
- D. UL Compliance: Comply with applicable requirements of UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", and UL 508, "Electrical Industrial Control Equipment" pertaining to installation of motor starters.
- E. UL Compliance: Provide motor starters and components which are UL-listed and labeled.
- F. IEEE Compliance: Comply with applicable requirements of IEEE Std. 241, "Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to motor starters.
- G. NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies", and Pub. No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)", pertaining to motor controllers/starters and enclosures.

PART 2 - PRODUCTS

2.01 MOTORS AND CONTROLS:

- A. All single speed starters for motors smaller than 1/2 horsepower shall be manual starters complete with overload and pilot light, and shall be furnished and installed by the Electrical Contractor. Starters shall be Square D Class 2510. Starters shall be designed for 120 volt, single phase service and shall be flush mounted in finished areas.
- B. Manual on-off switches shall be Square D 2510-KG-1 or KG-2.
- C. All starters and fusible combination magnetic starters for motors 1/2 horsepower and larger shall be furnished and installed by the Electrical Contractor and shall be magnetic motor starters as indicated on the Drawings. Starters shall be full voltage, non-reversing single-speed, NEMA 1 enclosed with overload heaters in each line. Starters shall be complete with 120 volt fused and grounded control transformer and heavy duty H-O-A selector switch mounted in the cover unless otherwise noted. The "hand" position of the selector switch shall be spring return to "off", unless noted on Drawings. A red pilot light, indicating motor running, shall be installed in the cover of each starter. If two speed starters are specified, they shall have decelerating relays. Starter shall be 208 Volt, or 480 Volt, as applicable, three-phase service as noted on the Drawings and shall be Square D Class 8538 or Engineer approved equal by General Electric, Siemens or Cutler-Hammer. Starters shall be mounted in panelboard type construction where indicated on the Drawings.
- D. Motor overload relay heater elements shall be sized at 100% of motor full load current for motor nameplate rating unless specifically noted otherwise by equipment manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Furnish and install conduit and wiring direct to the various starters and through to the motors, unless otherwise noted. The Mechanical Contractor will supply all motors for motor driven equipment and will furnish certain built-in starters, but the Electrical Contractor shall make all electrical connections thereto. All control devices and equipment, including pilot devices, will be furnished and installed by the Mechanical Contractor unless specifically noted otherwise.
- B. Certain equipment as noted on the Drawings will be furnished with built-in "package" type starters and/or control panels by others. Furnish and install disconnect for same and wire to control panel power terminals.

- C. The Contractor shall review the Drawings and Specifications for the plumbing, heating and ventilating work and shall conform to all conditions therein and shall coordinate his work accordingly.
- D. The Electrical Contractor shall be responsible for checking the correct rotation for all motors.
- E. The Electrical Contractor shall provide suitable service outlets under the direction of the Heating Contractor from which point the Heating Contractor shall wire and connect his automatic control devices. Furnish and install all required safety switches.

3.02 CONTROL WIRING:

- A. Furnish and install all items of standard motor control which are not packaged as a part of, or factory installed on, equipment furnished by others.
- B. Motor control shall be furnished to match the horsepower of motors furnished by other Contractors. The Electrical Contractor shall verify the characteristics of each motor with the Contractor furnished the motor before procuring motor control equipment.
- C. If motors are furnished which require larger starters and/or branch circuit conductors than indicated, the Contractor furnishing the motors shall reimburse the Electrical Contractor for the cost differential. It is the responsibility of each Contractor furnishing motors to advise the Electrical Contractor of the exact function of the systems to assure proper operation of the system.
- D. All motor starters and control station furnished by other than the Electrical Contractor will be delivered to the Electrical Contractor at the site for custody, erection in place, and all wiring connection.
- E. All electrical control power and motor control wiring shall be done by the Temperature Control Contractor, except:
 - 1. Temperature control wiring where indicated on the Electrical Drawings.
 - 2. Interlock wiring between various equipment components and starters, where indicated on the Electrical Drawings.

END OF SECTION 26 2914

SECTION 26 4313 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials and Methods sections, apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of surge protective devices is indicated on the drawings.
- B. Types of surge protective devices specified in this section include the following:
 - 1. Service Entrance Surge Protective Devices
 - 2. Branch Panel Surge Protective Devices

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of surge protective devices, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NFPA 70, Article 285 applicable to wiring methods, construction and installation of surge protective devices. Comply with Article 285 as applicable to surge protective devices.
- C. UL Compliance: Comply as applicable to UL 1449 4th edition, UL96A, UL 489, and UL 198 standards pertaining to surge protective devices.
- D. ANSI/IEEE Compliance: Comply with applicable current requirements of ANSI/IEEE standards C62.1, C62.41, C62.45, C62.62 and IEEE 1100-2005 pertaining to surge protective devices.

1.04 WARRANTY:

- A. The manufacturer shall warranty the surge protective device against failure for a period of five years from date of acceptance by the Owner. Upon notice from the Owner, the manufacturer shall remedy all such defects at his own expense at a time convenient to the Owner.
- B. The Electrical Contractor shall warranty the installation of the surge protective devices for a period of one year from date of acceptance by the Owner. Upon notice from the Owner, the Electrical Contractor shall remedy all such defects at his own expense at a time convenient to the Owner.

1.05 TEST REPORTS:

- A. Each specified surge protective device (SPD) shall be independently tested from an NVLAP or NRTL accredited test facility.
- B. Test shall be performed in accordance with UL 1449.
- C. Test reports shall include all documentation produced by testing laboratory and a summary sheet indicating all items outlined:
 - 1. SPD model
 - 2. SPD circuit description
 - 3. Nominal line voltage
 - 4. Maximum continuous operating voltage
 - 5. Connection means
 - 6. SPD protection modes
 - 7. Clamping voltage for B3 ringwave, 6 kV 3000A combination wave, B3/C1 combination wave. C3 combination wave and during maximum surge current for line-neutral, line-ground, neutral-ground and line-line.
 - 8. Minimum Repetitive Surge Current Capacity: Unit subject to an initial test conforming to UL 1449 guide lines (bench mark test) followed by a repetitive number of ANSI/IEEE C62.41.2-2002 (Cat C3) surges in one minute intervals (minimum of 3,500 impulses). Upon completion the unit shall be retested to the UL 1449 guidelines to verify survivability. Units shall not deviate more than 10% from first to final test to be considered to have achieved survival.
 - 9. Short Circuit Current Rating (SCCR)
- D. SPD units shall be tested with all specified options assembled and fully operational. Test shall simulate real field conditions.

1.06 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on the surge protective device including, but not limited to, life cycle rating, overcurrent protection, UL 1449 compliance, and surge current capacity. Manufacturer's current capacity shall be backed up by an independent test from an NVLAP or NRTL accredited test laboratory. The independent test report as outlined above shall be included with the submittal. Failure to include the independent test report will result in product disapproval.
- B. Shop Drawing: Submit layout drawings of the surge protective devices showing accurately scaled components, unit dimensions, weights, mounting provisions, connection details, and wiring diagrams.
- C. Equipment Manuals: Submit a manufacturer's installation manual with installation, start-up, spare parts list, and operating instructions.

PART 2 - PRODUCTS

2.01 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES:

- A. Surge Protective Devices (SPD) installed on the service entrance shall be designed for a 120/208V-3PH-4W, sixty-cycle service. The SPD shall have an integral disconnect mounted in the entry door.
- B. The SPD shall use single or multiple metal oxide varistors (MOVs) and polypropylene capacitors for the surge protection. Each MOV shall be fused for redundant protection and ongoing performance.
- C. The SPD shall be constructed using a solid copper bus construction. The copper bus bars shall carry the cumulative surge current.
- D. The SPD shall be rated for a maximum continuous operating voltage equal to no less than 115% of the nominal phase voltage.
- E. The SPD shall provide all modes of protection (L-N, L-G, L-L, N-G). The SPD shall protect to the following clamping voltages:

1. 120/208V Rated:

	B3 Ringwave	6 kV-3 kA UL VPR	C3 Comb Wave
L-N	350	700	900
L-G	425	700	900
N-G	375	700	900
L-L	450	1300	1300

- F. The SPD shall be capable of protecting against a single pulse surge current of 200kA on all modes (L-N, L-G, N-G, L-L). The SPD shall be capable of protecting against repetitive C3 (C High) surge currents of 3,500 impulses on all modes (L-N, L-G, N-G, L-L). The repetitive surge current test shall be conducted according to ANSI/IEEE C62.41 and C62.45 standards.
- G. The SPD shall include a system monitor. There shall be an audible alarm, phase status indicators and dual form "C" dry contacts.
- H. The SPD shall have a fault current protection rating of 100 kAIC.
- I. The SPD shall be rated as a UL-1449 Type 1 or Type 2 device with a nominal discharge (In) rating of 20 kA.
- J. The SPD shall be as manufactured by General Electric TRY-Y200 Series, APT/Siemens TPS3 1240 Series, Square D EMA48 Series, Emerson 510 Series or Engineer approved equal by Eaton or Mersen.

2.02 BRANCH PANEL SURGE PROTECTIVE DEVICES:

- A. Surge protective devices (SPDs) shall be installed on all branch panels as noted on the drawings. The SPD shall be designed for a 120/208V-3PH-4W, sixty-cycle electrical system as indicated on the drawings.
- B. The SPD shall use single or multiple metal oxide varistors (MOVs) and polypropylene capacitors for the surge protection. Each MOV shall be fused for redundant protection and ongoing performance.
- C. The SPD shall be constructed using a solid copper bus construction. The copper bus bars shall carry the cumulative surge current.
- D. The SPD shall be rated for a maximum continuous operating voltage equal to no less than 115% of the nominal phase.
- E. The SPD shall provide all modes of protection (L-N, L-G, L-L, N-G). The SPD shall protect to the following clamping voltages:

1. 120/208V Rated:

	B3 Ringwave	6 kV-3 kA UL VPR	C3 Comb Wave
L-N	350	700	900
L-G	425	700	900
N-G	375	700	900
L-L	450	1300	1300

- F. The SPD shall be capable of protecting against a single pulse surge current of 50,000A on all modes (L-N, L-G, N-G, L-L). The SPD shall be capable of protecting against repetitive surge current of 3,500 impulses on all modes (L-N, L-G, N-G, L-L). The repetitive surge current test shall be conducted according to ANSI/IEEE C62.41 and C62.45 standards.
- G. The SPD shall be rated as a UL-1449 Type 2 device with a nominal discharge (In) rating of 20 kA minimum.
- H. The SPD shall be as manufactured by General Electric TR5-Y065 Series, APT/Siemens TPS3 1240 Series, Square D EMA48 Series, Emerson 510 Series or Engineer approved equal by Eaton or Mersen.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The service entrance SPD shall be if the device is a Type 1, it can be installed on the line side of the main disconnect. The SPD shall be wired in parallel with the main distribution panel. The SPD shall be fed by a 100A3P switch/breaker in the MDP with #2 AWG copper conductors. The SPD shall be close nipped to the MDP and terminate on the nearest breaker/switch at panel entry point.
- B. The receptacle panel SPD shall be wired in parallel with the receptacle panel. The SPD shall be fed by a 30A3P circuit breaker mounted in the receptacle panel. The SPD shall be connected to the receptacle panel using #10 AWG copper conductors. The SPD shall be close nipped to the receptacle panel and terminate on the nearest breaker at panel entry point.
- C. SPD feed conductors shall be kept as short as possible. The Contractor shall twist the feed conductors together to reduce conductor impedance.
- D. SPD conductor lugs shall be torqued to the values recommended by the equipment manufacturer.

3.02 TESTING:

- A. Prior to turnover to the Owner, surge protective devices shall be tested for operation by the Contractor.

END OF SECTION 26 4313

SECTION 26 5100 – INTERIOR LUMINAIRES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials & Methods sections, apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. The contractor shall furnish, install and connect luminaires as shown on the Drawings. Luminaires are indicated on the Drawings with a type identifying letter, i.e., A, B, C, etc. A Luminaire Schedule on the Drawings identifies the luminaire in accordance with the identifying letters.
- B. Exterior luminaires mounted on the surface of the building shall conform to this section.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of luminaires of types and ratings required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to installation construction of interior building luminaires.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub. Nos., LE 1 and LE 2 pertaining to lighting equipment.
- D. ANSI/IES Compliance: Comply with ANSI 132.1 pertaining to interior luminaires and ANSI C82.4, C82.11 & C62.41 pertaining to ballast.
- E. ANSI/UL Compliance: Comply with ANSI/UL standards pertaining to interior luminaires for hazardous locations.
- F. UL Compliance: Provide luminaires which have been UL-tested and labeled.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on building luminaires. Submit luminaire data in booklet form and include the following items:
 - 1. Separate sheet for each luminaire
 - 2. Booklet shall be assembled in luminary "type" alphabetical order

3. Luminaire catalog number and all accessories clearly indicated on each sheet
 4. Each LED module shall include data information clearly indicating LED module manufacturer and model number.
 5. Each LED driver shall include data information clearly indicating LED driver manufacturer and model number
- B. Submittals not including all listed items shall be disapproved.

1.05 WARRANTY:

- A. Contractor shall warranty all installation and product free from mechanical and electrical defects for a period of one year from date of installation. All warranty labor service shall be included in this warranty.
- B. LED drivers shall be warranted to be free from defect in material and workmanship for a period of five (5) years.
- C. LED modules shall be warranted for five (5) years from the date of building acceptance by the Owner.

1.06 EXTRA MATERIALS:

- A. Exit Signs: Furnish 10% extra (minimum of 2) exit signs, including up to 50 feet of conduit and wiring for each sign.
- B. Furnish 10% (minimum of 1) additional of each lamp type and rating installed.
- C. Furnish 1% (minimum of 1) additional of each ballast type and rating installed.
- D. Extra materials shall be materials matching identically installed products and shall be furnished in packaging that identifies and protects the product for storage.
- E. Furnish 1% (minimum of 1) additional of each drive type.

PART 2 - PRODUCTS

2.01 LUMINAIRES:

- A. Surface mounted luminaires with labels, stickers, emblems that are visible after luminaire is installed shall have all visible labels except "UL" label removed.
- B. Surface mounted luminaires in finished areas shall contain no visible knockouts.
- C. All non-metallic louvers must meet state and local regulations regarding flame spread and smoke density generation.

- D. Exposed fasteners shall be flush with adjacent surface with matching finish. Mounting hardware shall be concealed where feasible.
- E. Recessed fluorescent luminaire housings shall be painted after fabrication with electrostatically applied baked white enamel with a minimum reflectance of 88%.
- F. All doors shall have mitered corners with white finish unless otherwise noted.
- G. Lamp sockets shall be keyed to lamp base for position oriented lamps and for open/enclosed ratings as required for each luminaire.

2.02 LED DRIVERS

- A. The LED drivers shall be matched to the LED mode system provided in the luminaire. The driver shall include the following features:
 - 1. 0-10V dimming control to provide luminaire dimming to 10% light output minimum.
 - 2. Rated to 100,000 hour operation.
 - 3. Moisture and vibration protection to the electronics.
 - 4. Module temperature control protection.
 - 5. Constant light output to regulate the light output over the life of the luminaire.
 - 6. End of life signal.
 - 7. Must have a minimum efficiency of 85%
 - 8. Must be rated to operate between -40°C to +50°C
 - 9. Input Voltage: capable of 120 to 480 (±10%) volt, single phase as required by the site
 - 10. Power supplies can be UL Class I or II output
 - 11. Operating frequency must be 50/60 Hz
 - 12. Drivers must have a Power Factor (PF) of: ≥ 0.90
 - 13. Drivers must have a Total Harmonic Distortion (THD) of: $\leq 20\%$
 - 14. Drivers must comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 - 15. Drivers must be Reduction of Hazardous Substances (RoHS) compliant. (see <http://www.rohs.eu/english/index.html>)

2.03. Expected Useful Life (Light Output) and Depreciation

- A. Useful Life Requirement: The useful life of the luminaire in terms of lumen output must be as minimum of 50,000 operating hours before reaching the L70 lumen output degradation point with no catastrophic failures.

B. Useful Life Testing and Verification Procedure:

1. Simplified L70 threshold: Perform LM-79-08 testing on the luminaire at both time intervals of 0 hours and $\geq 6,000$ hours. The luminaire must be operated continuously in the appropriate UL 1598/153 environment except when it is removed to perform the LM-79 light output tests. If the light output determined at $\geq 6,000$ hours is $\geq 96\%$ of the light output determined at 0 hours, the luminaire meets the simplified L70 threshold for useful life.
 - a. To demonstrate compliance a test report shall be issued showing measurement results at $T=0$, measurement results at $T \geq 6000$ hours and a summary table showing percent lumen output change and percent input power change.

2.04 Electrical System Requirements

- A. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low – $6kV/1.2 \times 50 \mu s$, $10kA/8 \times 20 \mu s$) waveforms at 1 minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C
- B. Under voltage protection via shutoff and short circuit protection via current limitation
- C. Internal luminaire design must incorporate modular electrical connections

2.05 CCT:

- A. CCT for luminaires shall be 4000K unless noted otherwise in the specifications or drawings. CCT tolerances shall be within a 3-step MacAdams ellipse and are to maintain a Min CRI of 80.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Provide structural support for recessed luminaires as required by code and/or local authority having jurisdiction.
- B. Install lamps in all luminaires installed under this Contract and furnished with equipment in accordance with the Luminaire Schedule, or as required. Lamps shall be new and unused prior to installation. All lamps shall be in working order at the time of final acceptance of the work by the Owner and the Engineer/Architect.

- C. Only the number of luminaires required to provide adequate lighting for work yet to be done in each area, and acceptable lighting elsewhere as determined by the Engineer/Architect shall be installed by the Contractor at the time luminaires are installed and tested. Remaining lamps and tubes are to be installed not more than ten days prior to acceptance of the project by the Owner. No incandescent lamps shall be utilized during construction for temporary lighting.
- D. Cleaning:
 - 1. Remove dirt, debris and bugs from enclosures.
 - 2. Clean photometric control surfaces as recommended by manufacturer.
- E. Contractor shall provide manufacturer product safety data sheets for all lamp and ballast types. The data sheets shall be included in the project "Operations and Maintenance" manuals.
- F. Contractor shall install extra exit signs as directed. Extra signs not installed shall be turned over to the Owner.
- G. Luminaires that are aimable shall be adjusted as directed.
- H. Luminaires shall be installed perpendicular and parallel to walls and ceiling. Luminaires shall be set level and plumb.

3.02 FIELD QUALITY CONTROL:

- A. Emergency lighting units shall be tested for illumination and normal power/battery power transfer.
- B. Luminaires and lamps shall be tested for normal operation and illumination.

END OF SECTION 26 5100

SECTION 26 5600 – EXTERIOR LUMINAIRES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Electrical Materials and Methods sections, apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. The contractor shall furnish, install, and connect exterior luminaires as shown on the Drawings. Luminaires are indicated on the Drawings with a type identifying letter, i.e., A, B, C, etc. A Luminaire Schedule on the Drawings identifies the luminaire in accordance with the identifying letters.
- B. The Contractor shall furnish and install concrete bases, poles and associated hardware.
- C. Exterior luminaires mounted on the surface of the building shall conform to the "Interior Lighting Luminaire Section", of the specification.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of luminaires of types and ratings required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to installation construction of exterior luminaires.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub. Nos., LE 1 and LE 2 pertaining to lighting equipment.
- D. ANSI/IES Compliance: Comply with applicable requirements pertaining to exterior luminaires and ANSI C82.4, C82.11 & C62.41 pertaining to ballast.
- E. ANSI/UL Compliance: Comply with ANSI/UL standards pertaining to exterior luminaires for hazardous locations.
- F. UL Compliance: Provide luminaires which have been UL-tested and labeled.
- G. NESC Compliance: Comply with IEEE C2, National Electrical Safety Code as applicable to exterior luminaires.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on building luminaires. Submit luminaire data in booklet form and include the following items:
 - 1. Separate sheet for each luminaire
 - 2. Booklet shall be assembled in luminary "type" alphabetical order
 - 3. Luminaire catalog number and all accessories clearly indicated on each sheet
 - 4. Each LED module shall include data information clearly indicating LED module manufacturer and model number.
 - 5. Pole data sheet shall include physical dimensions, structural information, anchor bolt pattern and finish.
- B. Submittals not including all listed items shall be disapproved.

1.05 WARRANTY:

- A. Contractor shall warranty all installation and product free from mechanical and electrical defects for a period of one year from date of installation. All warranty labor service shall be included in this warranty.
- B. LED drivers shall be warranted to be free from defect in material and workmanship for a period of five (5) years.
- C. LED modules shall be warranted for five (5) years from the date of building acceptance by the Owner.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.
- C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- D. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.07 EXTRA MATERIALS:

- A. Furnish 10% (minimum of 1) additional of each lamp type and rating installed.

- B. Furnish 1% (minimum of 1) additional of each ballast type and rating installed.
- C. Extra materials shall be materials matching identically installed products and shall be furnished in packaging that identifies and protects the product for storage.
- D. Furnish 1% (minimum of 1) additional of each drive type.

PART 2 - PRODUCTS

2.01 LUMINAIRES:

- A. Surface mounted luminaires with labels, stickers, emblems that are visible after luminaire is installed shall have all visible labels except "UL" label removed.
- B. Luminaires shall comply with UL-1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area of field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent
 - 2. Specular Surfaces: 83 percent
 - 3. Diffusing Specular Surfaces: 75 percent

- K. Lenses and Refractors Gaskets: Use heat- and aging resistant gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- M. Lamp Sockets: Lamp sockets shall be keyed to lamp base for position oriented lamps and for open/enclosed ratings as required for each luminaire.

2.02 LED DRIVERS

- A. The LED drivers shall be matched to the LED mode system provided in the luminaire. The driver shall include the following features:
 - 1. 0-10V dimming control to provide luminaire dimming to 10% light output minimum.
 - 2. Rated to 100,000 hour operation.
 - 3. Moisture and vibration protection to the electronics.
 - 4. Module temperature control protection.
 - 5. Constant light output to regulate the light output over the life of the luminaire.
 - 6. End of life signal.
 - 7. Must have a minimum efficiency of 85%
 - 8. Must be rated to operate between -40°C to +50°C
 - 9. Input Voltage: capable of 120 to 480 (±10%) volt, single phase as required by the site
 - 10. Power supplies can be UL Class I or II output
 - 11. Operating frequency must be 50/60 Hz
 - 12. Drivers must have a Power Factor (PF) of: ≥ 0.90
 - 13. Drivers must have a Total Harmonic Distortion (THD) of: $\leq 20\%$
 - 14. Drivers must comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
 - 15. Drivers must be Reduction of Hazardous Substances (RoHS) compliant. (see <http://www.rohs.eu/english/index.html>)

2.03 POLES:

- A. Poles shall be one-piece unless specifically noted otherwise. Furnish cast base covers for all poles. The pole and base shall be designed to withstand 90 MPH wind loads with a gust factor of 1.3 on the pole, base and luminaires.

- B. Poles whose fundamental natural frequency lies in the range of 3 to 6 CPS shall be provided with center tube vibration dampeners. Poles shall be designed such that the second harmonic of the natural frequency as induced by the Karman vortices shall occur at a wind velocity of not more than 7 MPH. Poles shall be provided with a center span cable support which will fix the branch circuit wires at the center of the pole diameter.
- C. Comply with luminaire manufacturer's mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- D. Mountings, fasteners and appurtenances shall be corrosion-resistant and compatible with support components.
 - 1. Material: Shall not cause galvanic action at contact points.
 - 2. Anchor bolts, leveling nuts, bolt caps and washers shall be hot-dip galvanized after fabrication, unless stainless steel items are indicated.
- E. Factory-painted finish shall comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- F. Die cast aluminum base cover, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- G. Poles 25'-0" and higher shall have center tube vibration dampeners.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install lamps in all luminaires installed under this Contract and furnished with equipment in accordance with the Luminaire Schedule, or as required. Lamps shall be new and unused prior to installation. All lamps shall be in working order at the time of final acceptance of the work by the Owner and the Engineer/Architect.
- B. Only the number of lamps and tubes required to provide adequate lighting for work yet to be done in each area, and acceptable lighting elsewhere as determined by the Engineer/Architect shall be installed by the Contractor at the time luminaires are installed and tested. Remaining lamps and tubes are to be installed not more than ten days prior to acceptance of the project by the Owner.
- C. Contractor shall provide manufacturer product safety data sheets for all lamp and ballast types. The data sheets shall be included in the project "Operations and Maintenance" manuals.
- D. Luminaires that are aimable shall be adjusted as directed.

- E. Luminaires shall have in-line fuses installed in pole at handhole in addition to internal protection.

3.02 POLE INSTALLATION:

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole. Poles shall be adjusted to be plumb and level in all directions.
- B. Poles and concrete bases shall be installed conforming to the following with respect to locations:
 - 1. Exact locations shall be coordinated with civil and landscape drawings.
 - 2. Poles shown at edge of parking lots shall be installed with edge of base no closer than 4" to the edge of the parking lot.
 - 3. Poles installed in the parking lot and within 5'-0" of the perimeter of the parking lot shall be installed on a concrete base extending no less than 27" above final grade.
 - 4. Poles shall be installed maintaining a minimum horizontal distance of 5'-0" from fire hydrants, storm drainage piping, water, gas, electric, communications and sewer lines.
 - 5. Poles shall be installed maintaining a minimum horizontal distance of 15'-0" from trees.
- C. Concrete pole foundations shall be cast-in-place, with anchor bolts to match pole-base flange. Concrete pole foundation shall be as detailed on drawings.
- D. Foundation-mounted poles shall be installed with leveling nuts. Tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
 - 2. Install base covers, unless otherwise indicated.
 - 3. Make a drain hole through grout to drain condensation from interior of pole.
- E. Raise and set poles using web fabric slings (not chain or cable). Luminaires shall be installed on poles prior to erection of the poles on the base. Under no circumstance shall poles be erected without luminaires mounted.

3.03 BOLLARD LUMINAIRE INSTALLATION:

- A. Align units for optimum directional alignment of light distribution.

3.04 CORROSION PREVENTION:

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 FIELD QUALITY CONTROL:

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Luminaires and lamps shall be tested for normal operation and illumination.
- C. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- D. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 5600

DIVISION 27 – COMMUNICATIONS
TABLE OF CONTENTS

<u>SECTION #</u>	<u>SECTION TITLE</u>	<u># OF PAGES</u>
27 5326	Emergency Responder Radio Coverage Testing	4

SECTION 27 5326 – EMERGENCY RESPONDER RADIO COVERAGE TESTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 1 – GENERAL are part of this Section as if written in full herein. Contractor is held to have familiarized himself with these provisions contained herein.

1.02 DESCRIPTION OF WORK

- A. Provide radio frequency testing for emergency responder radio coverage throughout the building for all radio frequencies in use by the emergency responders. This shall include fire, police, sheriff, EMS and any state, city or county responders frequencies as required by the AHJ.

1.03 QUALITY ASSURANCE

A. Codes and Regulations

- 1. Ohio Building Code, Section 916
- 2. Ohio Fire Code, Section 510
- 3. NFPA 72
- 4. TIA TSB-88.1-D – Wireless Communications Systems Performance in Noise and Interference - Limited Situations Part 1: Recommended Methods for Technology - Independent Performance Modeling

B. Qualifications

- 1. Contractor shall meet one of the following:
 - a. Firms regularly engaged and familiar with RF testing, systems, RF transmission principles with a minimum of 3 years' experience and 5 projects of similar type.
 - b. A professional engineer license or certification (i.e. P.E. or RCDD).

C. Definitions

- 1. ER – Emergency Responders
- 2. RF – Radio Frequency
- 3. DAQ – Delivered Audio Quality
- 4. AHJ – Authority Having Jurisdiction

1.04 SUBMITTALS

- A. Contractor shall submit the following:
1. Proof of Contractor qualifications as required in section 1.03-B.
 2. A list of the frequencies to be tested.
 3. Cut sheets of the instruments used for testing. Instruments shall be approved by the Owner or Engineer.
 4. Contact information of the ER official.
 5. A brief description of proposed testing procedures and method of documentation.
 6. Confirm with the fire chief areas deemed as critical requiring 99% coverage.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 TESTING

- A. Before testing, the Contractor shall verify and/or coordinate the following with the AHJ:
1. All frequencies used by emergency responders within the jurisdiction.
 2. Utilization of receiver base stations, repeaters or boosters in the radio system, and if so, where they are located.
 3. AHJ representation during the test. If representation is required either on-site or at receiver base station, costs involved shall be included in the Bid.
 4. Coordination with municipalities and the receiver base stations.
 5. Confirm if AHJ will waive radio coverage per OBC 510, Exceptions #1 and #2.
- B. The radio frequencies used by the ER shall be tested to ensure two-way coverage on each floor of the building to ensure the following:
1. Measurements in 95 percent of all areas (for pre-enhancement) and 90 percent (for post enhancement) on each floor of the building shall meet the following signal strengths:
 - a. Minimum signal strength into the building shall be -95 dBm.
 - b. Minimum signal strength out of the building shall be -95 dBm.
 2. Critical areas such as fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage.

C. The following testing procedure shall be followed:

1. RF Signal Strength Test

- a. The signal strength test shall be conducted using a calibrated (within last 12 months) spectrum analyzer utilizing antennas similar in use by the emergency responders.
- b. Where signal strength out of the building cannot be efficiently measured, a DAQ Test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.
- c. Each floor of the building shall be divided into a grid of 20 approximately equal test areas. No test area or floor grid of 20 shall exceed 128,000 square feet. Areas exceeding this square footage shall be divided into 20 additional test areas.
- d. Any floor area with 2 hour fire separation walls shall be treated as a separate building and have its own 20 area test grid.
- e. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
- f. Measurements shall be made with the antenna held in a vertical position at three (3) to four (4) feet above the floor to simulate portable radios worn on the belt or turnout coat pocket.
- g. A maximum of one (1) (or 5 percent) of nonadjacent test areas shall be allowed to fail the test per floor.
- h. In the event that two or more (or > 5 percent) of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of more than two (or 5 percent) nonadjacent test areas shall result in failure of the test. If the building fails the 40 area test, the building shall be deemed in non-conformance to Code. The facility shall be equipped with an in-building RF amplification antenna system to meet a 90 percent coverage requirement per floor and retested. The amplification system and retesting of said system shall be a separate project and is not part of this specification.
- i. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building Owner so that the measurements can be verified during annual tests.

2. Voice Signal Quality Test

- a. For quality purposes, DAQ readings shall be taken at the same time as the above RF signal strength measurements. The DAQ scale is as follows:
 - 1) DAQ 1: Unusable. Speech present but not understandable.
 - 2) DAQ 2: Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
 - 3) DAQ 3: Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
 - 4) DAQ 3.4: Speech understandable without repetition. Some noise or distortion present.
 - 5) DAQ 4: Speech easily understandable; little noise or distortion.
 - 6) DAQ 4.5: Speech easily understandable; rare noise or distortion.
 - 7) DAQ 5: Perfect; no distortion or noise discernible
- b. A DAQ level of 3 or better throughout the building shall be deemed acceptable and passing. Areas not achieving this level shall be deemed as failing.

3.02 DOCUMENTATION

- A. Upon completion of the testing, the Contractor shall provide a test report for approval by the Engineer and the fire code official/AHJ in a format required by the authority having jurisdiction (AHJ). The test results shall be in spreadsheet form, along with building floor plans with each floor overlaid with the test grid used in the testing procedures above. Each grid on the drawings shall show a minimum of "Pass/Fail" correlating with the spreadsheet data for that grid square for each frequency tested.
- B. A narrative report shall be submitted summarizing test methodology, instruments utilized, overall test results and a conclusion of facility conformance or non-conformance to building code.
- C. Test results shall indicate date, time and weather conditions at the time of the testing (i.e. temperature, humidity, fog, rain, snow, etc.).
- D. Drawings and report of these same test results shall also be included in the O&M documentation.
- E. Documentation shall be assembled and submitted in electronic format (pdf).

END OF SECTION 27 5326

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY
TABLE OF CONTENTS

<u>SECTION #</u>	<u>SECTION TITLE</u>	<u># OF PAGES</u>
28 4611	Duct Smoke Detector Monitoring System.....	4

SECTION 28 4611 - DUCT SMOKE DETECTOR MONITORING SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of duct smoke detector monitoring system work is indicated by drawings and schedules.

1.03 QUALITY ASSURANCE:

- A. Manufacturer: Firm regularly engaged in manufacture of duct smoke detector monitoring systems, of types, sizes, and electrical characteristics required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to construction and installation of duct smoke detector monitoring system components and accessories.
- C. UL Compliance and Labeling: Provide duct smoke detector monitoring system components which are UL-listed and labeled.
- D. FM Compliance: Provide duct smoke detector monitoring system and accessories which are FM approved
- E. ADAAG Compliance: Provide duct smoke detector monitoring system and accessories which are ADAAG approved.
- F. NFPA Compliance:
 - 1. NFPA 72 Installation, Maintenance and Use of Protective Signaling Systems
 - 2. NFPA 72E Automatic Fire Detectors
 - 3. NFPA 101 Life Safety Code
 - 4. NFPA 70 National Electrical Code
 - 5. NFPA 71 Central Station Code
 - 6. Local, State and National Codes, Local and State Fire Marshal Codes. It shall be the Contractor's responsibility to obtain approval from all reviewing agencies.

1.04 SUBMITTALS:

- A. Product Data: The manufacturer shall furnish to the Owner a one (1) year Contract effective from the date of installation for inspection service of the manufacturer's equipment with a minimum of two inspections during the Contract year. Equipment shall be checked out by an authorized manufacturer's representative and a letter of completion and compliance given to the Owner through the Electrical Contractor.
- B. The manufacturer shall supply the Owner with building wiring prints, equipment, schematics and necessary tools to maintain the system along with equipment operating instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide a duct smoke detector monitoring system of one of the following:
 - 1. Edwards Systems Technology (EST)
 - 2. Notifier
 - 3. Simplex Time Recorder Co.

2.02 DUCT SMOKE DETECTOR MONITORING SYSTEM:

- A. General:
 - 1. The equipment shall be standard products of a single manufacturer.
- B. System Operation:
 - 1. The activation of any automatic duct smoke detector or pull station circuit shall automatically perform the following functions:
 - a. Sound a continuous audible alarm signal and a visual alarm signal at the panel location.
 - b. Shut down the associated HVAC fan via the duct smoke detector's relay contact or per local authority having jurisdiction requirements (this may require all HVAC fans to be shut down upon activation of any initiating device).
 - c. Smoke detector in trouble condition shall activate a visible or audible signal at a location approved by local authority having jurisdiction (AHJ).

C. Equipment:

1. Smoke monitoring panel shall be solid state electronic type designed for surface or semi-flush mounting with locking door and tempered window. Panel shall contain the necessary zones (minimum of 4 zones), circuits and modules as indicated on the drawings, plus space for 20% future zones. The panel shall be equipped with remote dialer for monitoring by local monitoring service agent:
 - a. EST EST-1 Series
 - b. Notifier SFP-400B Series
 - c. Simplex 4004 Series
2. Duct type smoke detector shall be photoelectric type with sampling tube (sized to fit the duct) U.L. Listed D (I):
 - a. EST EST-6266B/6260A
 - b. Notifier DH400AC/DC Series
 - c. Simplex 4098-9681/4098-9601
3. Remote audible/visual device shall be horn with 15 candela strobe light:
 - a. EST 757-7A-T
 - b. Notifier H702415W-FR
 - c. Simplex 4903-9241
4. Fire Alarm Pull Station:
 - a. EST 270A-SPL
 - b. Notifier NBG-12L
 - c. Simplex 2099-9754
5. Ceiling Smoke Detector (mounted above panel) U.L. Listed OAP:
 - a. EST 6270B
 - b. Notifier 2400
 - c. Simplex 4098-9601/9788
6. Ceiling mounted remote test station and power on/alarm indicator (provide device as required by local authority having jurisdiction):
 - a. EST 6262A-001
 - b. Notifier RST451
 - c. Simplex 2098-9805

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Contractor shall furnish and install in accordance with the manufacturer's instructions all wiring, conduit, and outlet boxes for a complete system as described herein and as shown on the Drawings.
- B. All conductors shall be in conduit, unless otherwise noted. Conductors shall be UL listed for non-power limited fire protective circuit conductors per NEC Article 760, as required. Manufacturer recommended color code shall be used and all wires shall be tagged at all junction points. Conductors shall test free from shorts to ground or shorts between conductors.
- C. Final connections between the equipment and the wiring system shall be made under the direct supervision of the authorized manufacturer's representative.
- D. This Contractor shall warranty all equipment, labor on equipment, all wiring free from mechanical and electrical defects for a period of one year from the date of installation.
- E. The Contractor shall install two (2) 4-UTP telephone cables from the system panel to the main telephone backboard. Terminate to telephone system as directed by Owner or local telephone company.
- F. The power for control panel shall be a dedicated 20 Amp 120-Volt circuit from panelboard with breaker lock. The circuit breaker shall be marked with red identification and the words "FIRE ALARM CIRCUIT" directly adjacent to the circuit breaker. The source power circuit shall be permanently identified on the fire alarm control unit; the identification shall indicate power source panel name, location, and circuit number. Identification tags shall be engraved phenolic name plates with red face and with core.
- G. Fire alarm pull stations installed but not in service shall be covered and legibly labeled "Not in Service".
- H. Fire alarm devices installed but in service shall be covered for protection until system is in operation.

END OF SECTION 28 4611

SECTION 323119

METAL ORNAMENTAL FENCES AND GATES

1. PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish all labor, materials and appurtenances necessary for installation of the commercial ornamental steel fence system defined herein and as shown on Drawings.

1.02 DESCRIPTION OF WORK

- A. Work Included:
 - 1. A total commercial ornamental steel fence system design. The system shall include all components, including pickets, rails, posts, gates, hardware, and other miscellaneous items required.

1.03 QUALITY ASSURANCE

- A. Fence manufacturer shall be thoroughly familiar with the type of construction involved and materials and techniques specified.
- B. Installer Qualifications: Engage an experienced installer who has successfully completed metal fences of the same materials and extent required for this Project.
- C. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Architect's approval for layout and grades.

1.04 REFERENCES

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- C. ASTM D523 - Test Method for Specular Gloss.
- D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- E. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- F. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- G. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- H. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- I. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- J. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material and product used.
- B. Shop Drawings showing all dimensions, including lengths and heights, of each location and panel type, and gates, including hardware.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected.

1.06 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.07 PRODUCT WARRANTY

- A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 10 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for five (5) years from date of original purchase.

2. PART 2 MATERIALS

2.01 MANUFACTURER

- A. **Ameristar Aegis Plus, Majestic, Style M3 (3 Rail)** with custom horizontal rails in quantity as shown on Drawings, as manufactured by **Ameristar Fence Products, Inc.** in Tulsa, Oklahoma.
- B. Equal by other manufacturer as approved by Architect.

2.02 MATERIAL

- A. Steel material for fence framework (i.e. tubular pickets, rails and posts), when galvanized prior to forming, shall conform to the requirements of ASTM A924/A924M, with a minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft² (276 g/m²), Coating Designation G-60.
- B. Material for fence pickets shall be 3/4" square x 17 Ga. tubing. The cross-sectional shape of the rails shall conform to the manufacturer's ForeRunner double-wall design with outside cross-section dimensions of 1.50" square and a minimum thickness of 14 Ga. Picket holes in the ForeRunner rail shall be spaced 4.70" o.c. Picket retaining rods shall be 0.125" diameter galvanized steel. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

- C. Post cap adornments shall be manufacturers standard sloped top.

2.03 FABRICATION

- A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets.
- B. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails This can best be accomplished by using an alignment template. Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
- C. The manufactured galvanized framework shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage pretreatment/wash with zinc phosphate), an electrostatic spray application of any epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating, gray in color, with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). **The color shall be Black.** The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
- D. Completed panels shall be capable of supporting a 400 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.
- E. Swing gates shall be fabricated using 1.5" x 14ga. Forerunner double channel rail, 1.75" sq. x 14ga. gate ends, and 3/4" sq. x 17ga. pickets. Gates that exceed 6' in width will have a 1.5" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding, and shall match height and profile of fence sections.

3. PART 3 EXECUTION

3.01 PREPARATION

- A. All installation shall be laid out by the contractor in accordance with the approved Shop Drawings based on the construction plans.

3.02 FENCE INSTALLATION

- A. Fence post shall be spaced according to Table 3, plus or minus 1/2". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 42".

3.03 FENCE INSTALLATION MAINTENANCE

- A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces:
 - 1. Remove all metal shavings from cut area.
 - 2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
 - 3. Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens

shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray.

4. Use of parts or components by other manufacturers will negate the manufactures' warranty.

3.04 GATE INSTALLATION

- A. Gate posts shall be spaced according to the approved Shop Drawings. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

- A. Clean the jobsite of excess materials; post-hole excavations shall be disposed of as directed by the Contractor.

Table 1 – Minimum Sizes for Aegis Plus Posts				
Fence Posts	Panel Height			
2-1/2" x 12 Ga.	Up to & Including 8' Height			
3" x 12 Ga.	Over 8' Up to & Including 10' Height			
4" x 11 Ga.	Over 10' Height			
Gate Leaf	Gate Height			
	Up to & Including 6'	Over 6' Up to & Including 8'	Over 8' Up to & Including 10'	Over 12'
Up to 4'	2 1/2" x 12Ga.	3" x 12 Ga.	4" x 11 Ga.	4" x 11 Ga.
4'1" to 6'	3" x 12Ga.	3" x 12 Ga.	4" x 11 Ga.	4" x 11 Ga.
6'1" to 8'	4" x 11 Ga.	4" x 11 Ga.	6" x 3/16"	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	6" x 3/16"
10'1" to 12'	6" x 3/16"	6" x 3/16"	6" x 3/16"	8" x 1/4"
12'1" to 16'	6" x 3/16"	6" x 3/16"	8" x 1/4"	8" x 1/4"

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Aegis Plus – Post Spacing By Bracket Type								
Span	8' Nominal (92" Rail)							
Post Size	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"
Bracket	Commercial		Commercial		Commercial		Commercial	

Type	Universal Blvd. (BB311)		Line Blvd. (BB310)		Flat Mount (BB306)		Swivel (BB312)*	
Post Settings $\pm \frac{1}{2}$ " O.C.	95-1/2"	96"	95-1/2"	96"	95-1/2"	96"	*97"	*97- 1/2"
Span			6' Nominal (73.25" Rail)					
Post Size	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Commercial Universal Blvd. (BB311)		Commercial Line Blvd. (BB310)		Commercial Flat Mount (BB306)		Commercial Swivel (BB312)*	
Post Settings $\pm \frac{1}{2}$ " O.C.	76-3/4"	77-1/4"	76-3/4"	77-1/4"	76-3/4"	77-1/4"	*78-1/4"	*78- 3/4"
<p>*Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.</p>								

END OF SECTION

SECTION 323123

PLASTIC FENCES

1. PART 1 GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials and appurtenances necessary for installation of the commercial polyvinyl chloride (PVC) privacy fence system defined herein and as shown on Drawings.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has at least three years experience and has successfully completed at least five PVC fence projects of a similar scope to that indicated for this Project, with a successful construction record of in-service performance.
- B. Single-Source Responsibility: Obtain PVC fences, including accessories, fittings and fastenings from a single source.
- C. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Architect's approval for layout and grades.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material and product used.
- B. Shop Drawings showing all dimensions, including lengths and heights, of each location and panel type.
- C. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected.

1.04 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.05 PRODUCT WARRANTY

- A. 30 year non-prorated limited warranty for commercial applications.

2. PART 2 MATERIALS

2.01 MANUFACTURER

- A. General: Provide PVC fence materials recognized to be of the type indicated and tested to show compliance with indicated performances.

- B. Basis of Design: Certainteed Bufftech Chesterfield with CertaGrain Texture.
 - 1. Height: 6 feet.
 - 2. Color: Arctic Blend.

- C. Equal by other manufacturer as approved by Architect.

2.02 PVC FENCE COMPONENTS

- A. General: Woodgrain textured posts, rails, pickets, gate uprights, post caps and accessories shall be of high impact, ultra violet resistant, rigid PVC, and shall comply with ASTM D 1784, Class 14344B.
- B. Fence Posts: One piece extruded, of lengths indicated and pre-routed to receive rails at spacing indicated.
 - 1. Surface to contain woodgrain texture.
 - 2. Cross Section: 5"x5" minimum.
 - 3. Wall Thickness: 0.170" minimum.
 - 4. Corner Radius: 3/8" minimum.
- C. Rails: One piece extruded, of lengths indicated and pre-routed to receive pickets at spacing indicated.
 - 1. Surface to contain woodgrain texture.
 - 2. Cross Section: 2"x6" minimum.
 - 3. Wall Thickness: 0.090" minimum.
 - 4. Corner Radius: 5/16" minimum.
- D. Pickets: One piece extruded, of lengths indicated.
 - 1. Surface to contain woodgrain texture.
 - 2. Cross Section: 7/8"x7" minimum.
 - 3. Wall Thickness: 0.060" minimum.
 - 4. Corner Radius: 3/16" minimum.
 - 5. Picket Spacing: Full privacy.
- E. Post Caps: Molded one piece.
 - 1. Surface to contain woodgrain texture.
 - 2. Cross Section: Match post cross section.
 - 3. Thickness: 0.080" minimum.
 - 4. Configuration: Flat or four-sided as required for installation to top of posts.
- F. Accessories: Manufacturer's standard screw caps, rail end reinforcers and other accessories as required.

2.03 MISCELLANEOUS MATERIALS

- A. Stiffener Channels: Galvanized steel structural channel. Configure channels for concealed installation within PVC rails with pre-drilled holes for drainage.
- B. Fasteners and Anchorage: Stainless steel. All fasteners to be concealed or colored heads to match. Provide sizes as recommended by fence manufacturer.
- C. PVC Cement: As recommended by fence manufacturer.
- D. Completed panels shall be capable of supporting a 400 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.

2.04 CONCRETE

- A. Concrete: Provide concrete consisting of portland cement per ASTM C 150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2,000psi. Use at least four sacks of cement per cubic yard, 1-inch maximum size aggregate, 3-inch maximum slump. Use 1/2 inch maximum size aggregate in posts where required.
- B. Packages Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C 387 with clean to obtain a 2 to 3 inch slump.

2.05 REINFORCEMENT FOR FILLED POSTS

- A. Steel Reinforcing Bars: ASTM A 615, Grade 60, deformed #4 bars. Install two bars for each post to a length of six feet.

3. PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install fence in compliance with manufacturer's written instructions. During installation, PVC components shall be carefully handled and stored to avoid contact with abrasive surfaces. Install components in sequence as recommended by fence manufacturer.
 - 1. Install fencing as indicated on the drawings provided.
 - 2. Variations from the installation indicated must be approved.
 - 3. Variations from the fence installation indicated and all costs for removal and replacement will be the responsibility of the contractor.

3.02 FENCE INSTALLATION

- A. Excavation: Drill or hand-excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - 1. If not indicated on drawings, excavate holes for each post to a minimum diameter of 12 inches.
 - 2. Unless otherwise indicated, excavate hole depths not less than 36 inches.
- B. Posts: Install posts in one piece, plumb and in line. Space a maximum of 8 feet o.c. unless otherwise indicated. Enlarge excavation as required to provide clearance indicated between post and side of excavation.
 - 1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, terminate top of concrete footings 3 inches below adjacent grade and trowel to a crown to shed water.
 - b. Secure posts in position for manufacturers' recommendations until concrete sets.
 - c. After installation of rails and unless otherwise indicated, install reinforcing in posts in opposing corners of post as shown and fill end and gate posts with concrete to level as indicated. Concrete fill shall completely cover the reinforcing steel and gate hardware fasteners. Consolidate the concrete by striking the post face with a rubber mallet, carefully tamping around the exposed post bottom.
 - d. Install post caps. Use #8 screws, nylon washers and snap caps.
 - e. Remove concrete splatters from PVC fence materials with care to avoid scratching.
- C. Top and Bottom Rails: Install rails in one piece into routed hole fabricated into posts to receive top and bottom rails, and middle where necessary. Except at sloping terrain, install rails level.

1. Prior to installation of rails into posts, insert concealed steel channel stiffeners in top rail, where necessary. Bottom rails shall include minimum (2) 1/4" drainage holes.
 2. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.
- D. Middle Rails: Where necessary, install middle rails in one piece into routed hole in posts with larger holes facing down. Except at sloping terrain, install middle rails level. Secure mid rail to pickets with 2-#8 x 1-1/2" screws evenly spaced.
1. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.
- D. Pickets: Install pickets in one piece per manufacturer recommendations. Install pickets plumb.
- F. Fence Installation at Sloping Terrain: At sloping terrain rails may be racked (sloped) or stepped to comply with manufacturers' recommendations.

3.05 ADJUSTING AND CLEANING

- A. Clean the jobsite of excess materials; post-hole excavations shall be disposed of as directed by the Contractor.
- B. Remove all traces of dirt and soiled areas from fence.

END OF SECTION

SECTION 329000
EXTERIOR PLANTING

1. PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. Provide exterior plants as indicated on drawings, as specified, and as required for proper completion of the work.
 - 1. Trees.
 - 2. Shrubs.
 - 3. Ground cover.
 - 4. Plants.

1.02 DEFINITIONS

- A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.
- B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Qualification Data: For landscape Installer.
- D. Material Test Reports: For existing surface soil.
- E. Planting Schedule: Indicating anticipated planting dates for exterior plants.

- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.
- D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- F. Observation: Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver exterior plants freshly dug.
- B. Do not prune trees and shrubs before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- C. Handle planting stock by root ball.
- D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.
 - 1. Set balled stock on ground and cover ball with soil, peat moss, mulch, or other acceptable material.
 - 2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.06 COORDINATION

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.
- B. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Architect.
 1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.07 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from incidents that are beyond Contractor's control.
 1. Warranty Period for Trees and Shrubs: One year from date of Substantial Completion.
 2. Warranty Period for Ground Cover and Plants: Six months from date of Substantial Completion.
 3. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
 4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

2. PART 2 PRODUCTS

2.01 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.
- D. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.02 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.
 1. Provide balled and burlapped trees.
 2. Branching Height: One-half of tree height.
- B. Small Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:
 1. Stem Form: As noted on drawings.

2. Provide balled and burlapped trees.

- C. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:
 1. Stem Form: As noted on drawings.
 2. Provide balled and burlapped trees.

2.03 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
 1. Provide balled and burlapped or container grown shrubs: As noted on drawings.

2.04 CONIFEROUS EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
- B. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens and the following grade:
 1. Heavy Grade: As noted on drawings.
 2. Provide balled and burlapped trees.

2.05 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
 1. Provide balled and burlapped or container-grown shrubs.

2.06 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated on drawings, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.07 PLANTS

- A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.
- B. Fast-Growing Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

2.08 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1/2 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.
 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 2. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.

2.09 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
 - 2. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.
 - 3. Provide lime in form of dolomitic limestone.
- B. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- C. Aluminum Sulfate: Commercial grade, unadulterated.
- D. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

2.10 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (13-mm)] sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 percent of dry weight.
- B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

2.11 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. (NPK ratio 1-1-1).

2.12 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. **Type: Triple-Processed Shredded Mixed Hardwood Mulch.**

2.13 STAKES AND GUYS

- A. Upright and Guy Stakes: As indicated on drawings.
- B. Hose Chafing Guard: As indicated on drawings.
- C. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.14 MISCELLANEOUS PRODUCTS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- B. Landscape Edging: Aluminum (3/16 inches x 4 inches) black color as manufactured by Permaloc, Inc. or approved equal. Install per manufacturers instructions.

2.15 PLANTING SOIL MIX

- A. Planting Soil Mix: Prepare on site by mixing four (4) parts topsoil to one part peat, adding 5 lbs. of slow release fertilizer to each cubic yard of mixture. Mixing shall be done by mechanical means.

3. PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.
- D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.03 PLANTING BED ESTABLISHMENT

- A. Loosen subgrade of planting beds to a minimum depth of 8 inches (150 mm). Remove stones larger than 1/2 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Spread planting soil mix to a depth of 8 inches (150 mm) but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

- C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.04 TREE AND SHRUB EXCAVATION

- A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
 - 1. Excavate at least 18 inches (300 mm) wider than root spread to accommodate vertical roots for bare-root stock.
 - 2. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.
- B. Subsoil removed from excavations may not be used as backfill.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.05 TREE AND SHRUB PLANTING

- A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 2 inches above adjacent finish grades.
 - 1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- B. Set balled and potted and container-grown stock plumb and in center of pit or trench with top of root ball 2 inches above adjacent finish grades.
 - 1. Carefully remove root ball from container without damaging root ball or plant.
 - 2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- C. Organic Mulching: Apply 3" thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.

3.06 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread.
- B. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.
- C. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees.

3.07 GUYING AND STAKING

- A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 60 inches (1830 mm) above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Use the number of stakes as follows:
 - 1. Use 2 stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; 3 stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.

3.08 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants as indicated on drawings.
- B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.09 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated.
 - 1. Organic Mulch: Apply 3-inch (75-mm) average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 CLEANUP AND PROTECTION

- A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.
- B. Protect exterior plants from damage due to landscape operations, operations by other contractors, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.11 DISPOSAL

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off site.

END OF SECTION



Proposed Genoa Bank

**1701-1707 W State St
Fremont, Ohio**

Geotechnical Subsurface Investigation

**Genoa Bank Company
Genoa, Ohio**

February 15, 2023

CT Project No. 229493



LEADING THROUGH THE NEXT 100 YEARS
www.ctconsultants.com

**CT Consultants, Inc.
1915 North 12th Street
Toledo, OH 43604-5305
419-342-2222
www.ctconsultants.com**



CT Project No. 229493
(TTL Project. No 2333401)

Mr. Marty Sutter
President
Genoa Bank Company
801 Main Street
Genoa, Ohio 43430

Geotechnical Subsurface Investigation
Proposed Genoa Bank
1701-1707 West State Street
Fremont, Ohio

Dear Mr. Sutter,

CT Consultants, Inc. (CT), previously TTL, Associates, Inc., has prepared the report of our geotechnical subsurface investigation at the site of the referenced project. This investigation was performed in general accordance with TTL Proposal No. 2333401 dated December 12, 2022 and authorized by you via a signed Agreement of Services dated December 13, 2022.

This report contains the results of our study, our engineering interpretation of the results with respect to the project characteristics, and our recommendations for design and construction of foundations and pavements.

Soil samples collected during this investigation will be stored at our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you. Should you have any questions regarding this report or require additional information, please contact our office.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

CT Consultants, Inc.

Luke G. Holmes, EIT
Geotechnical Professional II

Curtis E. Roupe, P.E.
Vice President



GEOTECHNICAL SUBSURFACE INVESTIGATION
PROPOSED GENOA BANK
1701-1707 WEST STATE STREET
FREMONT, OHIO

FOR

GENOA BANK COMPANY
801 MAIN STREET
GENOA, OHIO 43430

SUBMITTED

FEBRUARY 15, 2023
CT PROJECT NO. 229493

CT CONSULTANTS, INC.
1915 NORTH 12TH STREET
TOLEDO, OHIO 43604
(419) 324-2222
(419) 321-6257 (FAX)



TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 INVESTIGATIVE PROCEDURES.....	2
3.0 PROPOSED CONSTRUCTION	4
4.0 GENERAL SITE AND SUBSURFACE CONDITIONS	5
4.1 General Site Conditions.....	5
4.2 General Soil Conditions.....	5
4.3 Groundwater Conditions	6
5.0 DESIGN RECOMMENDATIONS.....	8
5.1 Shallow Foundations.....	8
5.1.1 Building and Canopy Foundations	8
5.1.2 Bank Vault Foundations.....	10
5.2 Seismic Considerations	11
5.3 Subgrades.....	12
5.3.1 Existing Subgrade.....	12
5.3.2 Modified Subgrade	12
5.4 Floor Slabs and Reinforced Slabs.....	13
5.5 Flexible (Asphalt) Pavement	13
5.6 Rigid (Concrete) Pavement	14
5.7 Pavement Drainage.....	15
5.8 Groundwater Control and Drainage	15
5.9 Excavations and Slopes.....	15
6.0 CONSTRUCTION RECOMMENDATIONS	17
6.1 Site and Subgrade Preparation	17
6.2 Fill.....	19
6.3 Foundation Excavations	20
7.0 QUALIFICATION OF RECOMMENDATIONS	21

PLATES

Plate 1.0 Site Location Map
Plate 2.0 Test Boring Location Plan

FIGURES

Logs of Test Borings
Legend Key
Summary of Soil Test Data
Grain Size Distribution

1.0 INTRODUCTION

This preliminary geotechnical subsurface investigation report has been prepared for the proposed Genoa Bank located at 1701-1707 West State Street in Fremont, Ohio. The general project site is presented on the attached Site Location Map (Plate 1.0).

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures, presents the findings, discusses our evaluations and conclusions, and provides our design and construction recommendations for foundations and pavements.

This investigation was performed in general accordance with TTL Proposal No. 2333401 dated December 12, 2022 and authorized by you via a signed Agreement of Services dated December 13, 2022.

The purpose of this investigation was to evaluate the subsurface conditions and laboratory data relative to the design and construction of foundations, building slabs, and pavements at the referenced site. To accomplish this, CT performed four (4) test borings, field and laboratory soil testing, and a geotechnical engineering evaluation of the test results.

This report includes:

- A description of the subsurface soil and groundwater conditions encountered in the borings.
- Design recommendations for building foundations, floor slabs, and pavements related to the proposed development.
- Recommendations concerning soil- and groundwater-related construction procedures such as site preparation, earthwork, foundation and pavement construction, and related field testing.

This investigation did not include an environmental assessment of the subsurface materials at this site.

2.0 INVESTIGATIVE PROCEDURES

This subsurface exploration included four (4) test borings performed by CT on January 25, 2023, designated as B-1 through B-4. The test borings were located in the field by Duket Architects Planners. The approximate locations of the borings as well as the approximate locations of the proposed structures are shown on the Test Boring Location Plan (Plate 2.0).

The test borings were performed in general accordance with geotechnical investigative procedures outlined in ASTM Standard D 6151. The test borings performed during this investigation were drilled with a track-mounted drilling rig utilizing 2¼-inch inside diameter hollow-stem augers. The Borings B-1, B-2, and B-3, were terminated at the planned depths of 10, 20, and 15 feet, respectively. Boring B-4 was extended 5 feet past its planned depth to a depth of 25 feet in an attempt to encounter the bottom of the Stratum III soft to very soft soils.

During auger advancement, soil samples were collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter. Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The samples were sealed in jars and transported to our laboratory for further classification and testing.

All of the recovered samples of the subsoils were visually or manually classified in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 and D 2488). The recovered samples were tested in our laboratory for moisture content (ASTM D 2216). Dry density determinations and unconfined compressive strength tests by the constant rate of strain method (ASTM D 2166) were performed on select intact cohesive samples retrieved from the building borings. Unconfined compressive strength estimates were obtained for the remaining intact cohesive samples using a calibrated hand penetrometer. A particle size

analysis (ASTM D 6913 and D 7928) and an Atterberg limits test (ASTM D 4318) were performed on representative soils from Borings B-1 (SS-1) to determine soil classification and soil index properties. The test results are presented on the Logs of Test Borings, Tabulation of Test Data sheets, and Grain Size Distribution sheet attached to this report.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as field logs of the encountered soils.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings made at specific locations. Particularly at previously developed sites, Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

3.0 PROPOSED CONSTRUCTION

It is our understanding that the project will include a new Genoa Bank branch building at 1701-1707 West State Street in Fremont, Ohio. Associated pavements are indicated to be surrounding the proposed building. Additionally, a canopy is indicated northwest of the building for a banking 'drive-thru'.

It is anticipated that any structural loads will generally be supported on shallow spread foundations. Structural loads were not available at the time of this report, however, are anticipated to be on the order of 100 kips for columns and 3,000 pounds per lineal foot (plf) wall loads. An approximately 35,000-pound bank safe is planned to be supported on reinforced slab with the dimensions of approximately 10 by 16-feet.

Pavements for this development are anticipated to consist of asphalt (flexible) and/or concrete (rigid) pavements.

Final design grades are anticipated to approximate existing grades.

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site Conditions

At the time of our exploration the site consisted predominantly of a snow-covered area with pavements.

Grades across the site were generally flat.

The surface materials encountered in the borings consisted of asphalt pavement and asphalt fragments mixed with crushed stone on the order of 4 to 14 inches in thickness.

4.2 General Soil Conditions

Based on the results of our field and laboratory tests, the subsoils encountered underlying the surface materials can be generally characterized as three strata of cohesive soils with varying strength and moisture characteristics and a zone of granular soils.

Stratum I consisted of **very soft** to **soft** cohesive soils encountered underlying the asphalt and asphalt fragments in Borings B-1, B-2, and B-4 as well as underlying the existing fill materials in Boring B-3 to depths generally ranging from 5 to 7 feet below existing grade. However, in Boring B-1 this stratum encountered a zone of granular soils (*described below*) at a depth of 3½ feet. The cohesive soils consisted sandy silt (ML), silty clay (CL-ML) and lean clay (CL), each generally with varying amounts of sand and gravel. Traces of organics were encountered in the upper most sample in Boring B-4. SPT N-values generally ranged from 2 to 4 blows per foot (bpf). Unconfined compressive strengths for the cohesive soils were generally 500 pounds per square foot (psf) or the samples were not intact enough to test. Moisture contents for the Stratum I soils ranged from 20 to 29 percent. A Liquid limit of 37 percent and a plasticity index of 18 percent was determined for the sample obtained from this stratum in Boring B-1 (SS-1). These values, along with gradation results, are indicative of lean clays (CL) with sand as classified in accordance with the Unified Soil Classification System (USCS).

A zone of **loose** granular soils was encountered underlying the Stratum I soils in Boring B-1 to a depth of 9.3 feet. Soils consisted of silty sand (SM) and silty clayey sand (SC-SM). SPT N-values ranged from 5 to 10 bpf. Moisture contents ranged from 22 to 26 percent.

Stratum II consisted of predominantly medium stiff cohesive soils encountered underlying the Stratum I in Borings B-2, B-3, and B-4, to depths ranging from 8.8 to 9.4 feet. The cohesive soils consisted of sandy silt (ML) and silty clay (CL-ML) with sand. SPT N-values were generally on the order of 6 bpf. Moisture contents ranged from 24 to 26 percent.

Stratum III consisted of **very soft** to **soft** cohesive soils encountered underlying the zone of granular soil in Borings B-1 to a termination depth of 10 feet as well as underlying Stratum II in Borings B-2, B-3, and B-4 to terminations depths of 20, 15, and 25 feet, respectively. The soil types, SPT-N values, and moisture contents were generally equivalent to those encountered in Stratum I. The unconfined compressive strengths generally ranged from 280 to 1,000 psf.

Additional descriptions of the stratigraphy encountered in the borings are presented on the Logs of Test Borings.

4.3 Groundwater Conditions

Groundwater was observed during drilling in all borings at depths ranging from 3 to 6 feet below existing grade. Groundwater observed upon completion of drilling in only Boring B-3, at a depth of 12 feet. A summary of the groundwater in each boring is provided in the table below. It should be noted that test borings were drilled and backfilled within the same day. In any case, instrumentation was not installed to observe long-term groundwater levels.

Table 4.4 Summary of Groundwater in Borings		
Boring Number	Approximate Depth of Groundwater (Feet)	
	Initially Encountered	Observed Upon Completion
B-1	6	-
B-2	5	-
B-3	3	12
B-4	5	-

" - " = Not Encountered

Based on the limited data available, such as the soil characteristics and the moisture conditions encountered in the borings, it is our opinion that the “normal” groundwater level may generally be encountered at depths ranging from approximately 8 to 10 feet below existing grades. However, this investigation did not include research of possible hydrological influences at the project site. It should be noted that groundwater elevations can fluctuate with seasonal and climatic influences. In particular, “perched” water may be encountered in existing fill materials, granular soils, or sandy silt soils that are underlain by relatively impermeable native cohesive soils. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this investigation.

5.0 DESIGN RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction and on the data obtained during the field investigation. If the project information or location as outlined is incorrect or should change significantly, a review of these recommendations should be made by TTL. These recommendations are subject to the satisfactory completion of the recommended site and subgrade preparation and fill placement operations described in Section 6.0, "Construction Recommendations".

5.1 Shallow Foundations

5.1.1 Building and Canopy Foundations

Based on the results of the field and laboratory testing for the borings performed in the general area of the proposed building footprint, exterior foundation excavations at a depth of 3½ feet (minimum required depth for protection from frost penetration) and shallower interior foundation excavations are anticipated to encounter predominantly Stratum I very soft to soft native cohesive soils or zones of existing cohesive fill materials. Based on nearby pavement Boring B-1, saturated loose granular soils may also be present at bearing elevations. The encountered soils at the anticipated bearing elevations are not considered suitable for support of the proposed foundations. Where existing fill materials, soft cohesive soils, or loose granular soils are encountered, they will need to be over-excavated and replaced with new engineered fill, as discussed below.

Where the soft cohesive soils, existing fill materials, loose granular soils, or other unsuitable foundation soils are encountered during foundation installation, over-excavation should extend through these materials to suitable bearing soils or per minimum over-excavation guidelines as follows. Based on the building borings, suitable medium stiff sandy silt or silty clay soils with a minimum unconfined compressive strength of 1,500 pounds per square foot (psf) are anticipated at depths on the order of 5 to 7 feet below existing grades. For column foundation locations, over-excavation should extend to this soil layer (but no deeper than 9 feet below existing grade, should this layer not be encountered). For wall foundations, over-excavation should extend to a depth below foundation bearing depth equal to 1.25 times the foundation width or to encounter the medium stiff cohesive soils, whichever is shallower.

Diligent dewatering operations should be anticipated for excavations that extend deeper than 4 feet below existing grade due to the potential for perched water in the sandy silt soils.

In all cases, the footing over-excavation shall be widened one foot for every foot of depth below the planned bearing depth, with the over-excavation centered along the footing. The over-excavated areas should be backfilled with dense-graded aggregate, placed in controlled lifts, and compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). Alternatively, the over-excavated areas could be backfilled flowable controlled-density fill having a minimum compressive strength of 300 psi. Based on the presence of additional very soft to soft cohesive soils underlying the medium stiff to stiff cohesive soils layer at depths on the order of 8½ to 9½ feet below existing grades, backfill should be utilized to achieve original planned bearing elevations to reduce foundation stress on the lower-profile soft soils for improved bearing capacity and reduced settlement. Foundations should not be placed at the base of the over-excavation.

Following the satisfactory completion of the site preparation and footing excavation inspections, including over-excavation of the unsuitable soils as described above, the proposed building may be supported on a conventional shallow spread foundation system consisting of wall (strip) and/or column (square) footings. We recommend a net allowable bearing pressure of 1,500 pounds per square foot (psf) for individual column (square) footings and continuous wall (or strip) footings. In using a net allowable soil pressure, the weight of the footings, backfill over the footings, or floor slabs need not be included in the structural loads for dimensioning footings. The bearing materials should consist of new engineered fill placed after over-excavation as described above and in Section 6.2.

Due to the encountered unsuitable bearing soils, as well as the existing site development, we strongly recommend that the bearing surface at the bottom of all footing excavations be inspected during construction by a CT geotechnical engineer or qualified representative. Inspection should be performed to verify that the exposed soil conditions at the bearing elevations are consistent with the subsurface conditions encountered in the test borings, over-excavation of unsuitable soils has been performed as prescribed in this report, and engineered fill has been properly placed for suitable foundation bearing. If the results of

hand penetrometer or other strength tests indicate the exposed soil conditions are not suitable for the design bearing pressure, it may be necessary to increase the footing size to accommodate the lower bearing strengths or to further over-excavate and backfill with engineered fill or flowable fill. It should be noted that the sandy silt soils associated with Stratum II are particularly sensitive to vibrations that may occur from construction and footing excavations. If hand penetrometer results do not indicate suitable unconfined compressive strength of 1,500 psf, Shelby tube samples could be obtained by hydraulic advancement with the bucket of a backhoe. The samples could then be returned to the CT laboratory for unconsolidated-undrained triaxial compressive strength testing to confirm a minimum undrained shear strength of 750 psf.

All exterior footings and footings in unheated areas should be constructed at a minimum frost penetration depth of 3½ feet below finished exterior grades. Interior footings may bear at a convenient depth below the floor slab, provided they are supported on properly placed and compacted engineered fill placed after over-excavation as described above. Wall (strip) footings should be at least 18 inches wide and column (square) footings should be at least 30 inches square, regardless of sizing based on design loads and the allowable bearing pressure. It should be noted that use of trench footings (i.e., placement of foundation concrete without forming) should not be anticipated for this project, due to the need for over-excavation of unsuitable soils and widening of footing excavations. Forming of footings and backfilling around CMU or poured foundation walls should be anticipated for the structure foundations.

Utilizing the above allowable bearing pressure and proper foundation inspection techniques, the total settlement associated with the structure should not exceed 1 inch, and differential settlement should not exceed ¾ inch.

5.1.2 Bank Vault Foundations

It was indicated that the bank's main vault, on the order of 35,000 pounds in total weight, would be supported on a reinforced slab, with dimensions on the order of 10½ by 16 feet, rather than on wall or column foundations. As a result, bearing pressures associated with the slab are anticipated to be considerably lower than those associated with the building

foundations. Over excavation of the unsuitable soils to suitable bearing soils or per minimum over-excavation guidelines described in the section above are not anticipated to be required for the slab foundation.

CT recommends over excavation of the unsuitable soils to a minimum of 1 foot below the slab. The over-excavation shall be widened one foot for every foot of depth below the planned bearing depth, with the over-excavation centered along the footing. The over-excavated areas should be backfilled with dense-graded aggregate, placed in controlled lifts, and compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). Alternatively, the over-excavated areas could be backfilled with flowable controlled-density fill having a minimum compressive strength of 300 psi.

Following the satisfactory completion of the site preparation and footing excavation inspections, including over-excavation of the unsuitable soils as described above, the proposed vault may be supported on a reinforced slab foundation. We recommend a net allowable bearing pressure of 500 pounds per square foot (psf) for the slab. The bearing materials should consist of new engineered fill placed after over-excavation as described above, in the above section, and in Section 6.2.

Additional slab recommendations are provided in Section 5.4.

5.2 Seismic Considerations

We have reviewed seismic design parameters in accordance with the Ohio Building Code (OBC) criteria, which references ASCE 7-10. It should be noted that the OBC seismic site characterization is based on the upper 100 feet of the geologic profile. The structure borings for this investigation were terminated as deep as 25 feet below existing grades. Therefore, our evaluation is based solely on the encountered overburden soils.

Based on IBC Section 1613.3.2, which references ASCE 7-10, utilizing the SPT N-value method, the weighted average N-value for the profile was calculated to be less than 15 blows per foot (bpf). Based on this average N-value, the site can be characterized as Site Class E (soft soil) in accordance with ASCE 7-10 Table 20.3-1.

If a Site Class E designation will be restrictive to structural design, it may be prudent to perform deeper borings with shear wave velocity testing. Development of a shear wave velocity profile is typically performed in conjunction with down-hole or cross-hole seismic testing, which would require additional boreholes and specialized testing equipment. It should be noted that shear wave velocity testing is comparatively costly to SPT borings and there is no guarantee that such testing would yield a more favorable site class designation.

5.3 Subgrades

5.3.1 Existing Subgrade

The subgrades that would result upon the satisfactory completion of the site preparation as described in Section 6.0 of this report are generally considered suitable for support of the proposed pavements. Based on field and laboratory data developed during this exploration, the subgrade soils consist of predominantly native cohesive soils. Laboratory analyses for the samples obtained from the borings, as well as visual descriptions of the upper soil profile, indicate that the cohesive subgrade soils may be generally classified as Group A-6b soils in accordance with the Ohio Department of Transportation (ODOT) system of soil classification. The cohesive soils are considered fair to poor as subgrade materials because they have relatively low permeabilities and a high percentage of silt and clay particles, which makes them susceptible to moisture, frost penetration, and frost heave.

At the time of this exploration, moisture contents in the upper 2½ feet of the cohesive subgrade soils ranged from approximately 20 to 22 percent. These moisture contents are estimated to vary from slightly to significantly above the expected optimum moisture content for these soils. Remedial action should be expected to be required to adjust the moisture contents of the existing soils and achieve proper compaction of the subgrade.

5.3.2 Modified Subgrade

If soils are dry of optimum, water should be uniformly mixed into the subgrade. More likely at this site, where soils wet of optimum are encountered, lowering the moisture content by scarification and aeration (discing and exposure to sun and wind) may be required. Very moist to wet soils will “pump” under the operation of heavy equipment, resulting in deep

rutting and perhaps rendering the operation of grading and paving equipment difficult or impossible.

If the schedule does not allow for scarification and aeration, other methods of subgrade modification may be required in areas of high moisture content. Modification may be achieved by undercutting and replacement with granular subbase (possibly in combination with a geotextile separation layer or geogrid reinforcement), mixing stone into the subgrade, or treating the subgrade with cement. The method of subgrade modification should be determined at the time of construction (See Section 6.1, "Construction Recommendations - Site and Subgrade Preparation").

5.4 Floor Slabs and Reinforced Slabs

It is recommended that all floor slabs be "floating," that is, fully ground supported and not structurally connected to walls or foundations. This is to reduce the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation. Such movements could be detrimental to slabs that are rigidly connected to the foundations. There may be certain areas where it will be difficult or impractical to make the slab floating. In such areas, it may be necessary to increase the slab thickness and reinforcement to prevent the foundation from cracking the slab and settling independently.

For properly prepared subgrade soils, a modulus of subgrade reaction (k) of 145 pounds per cubic inch (pci) may be used for floor slab design. It is recommended that the floor slab be supported on a minimum 6-inch layer of relatively clean granular material such as sand and gravel or crushed stone. This is to help distribute concentrated loads and provide more uniform subgrade support beneath the slab.

5.5 Flexible (Asphalt) Pavement

Based on the results of the gradation analyses and Atterberg limits testing, as well as visual classification of the recovered samples, we recommend a subgrade CBR value of 5 percent for the Group A-6b or better soils. This CBR value is based on subgrade compacted to at

least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling.

It should be noted that we are not privy to the design traffic loads or intended design life. The subgrade support recommendations indicated herein should be reviewed by the site engineer in conjunction with the design traffic criteria to determine the required pavement sections. In any case, we recommend the light-duty pavement cross-section consist of at least 3 inches of asphalt underlain by 6 inches of aggregate base for even the lightest-duty pavements based on our experience regarding environmental exposure and reasonable serviceability. For the same reason, we recommend the heavy-duty pavement cross-section consist of at least 4 inches of asphalt underlain by 8 inches of aggregate base. These sections are also considered the minimum light-duty and heavy-duty sections based on the Dollar General Technical Requirements document.

All paving operations should conform to the Ohio Department of Transportation (ODOT) specifications. The pavement and subgrade preparation procedures outlined in this report should result in a reasonably workable and satisfactory pavement. It should be recognized, however, that all flexible pavements need repairs or overlays from time to time as a result of progressive yielding under repeated traffic loads for a prolonged period of time, as well as exposure to freeze-thaw conditions.

5.6 Rigid (Concrete) Pavement

For properly prepared subgrade soils, a modulus of subgrade reaction (k) of 145 pounds per cubic inch (pci) may be used for rigid pavement design. A concrete pavement section is recommended in the loading-unloading areas, areas of repetitive turning, site exit and entrance aprons, and trash enclosure areas (including where the truck parks while servicing the container). This section should consist of a minimum of 6 inches of reinforced, air-entrained concrete with a minimum compressive strength of 3,500 pounds per square inch (psi) underlain by a minimum of 6 inches of a dense-graded granular base. These rigid (concrete) pavement design recommendations meet and exceed the minimum criteria designated in the Dollar General Technical Requirements document for light-duty and heavy-duty concrete pavements. The pavement section should be supported on a subgrade

compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling. All paving operations should conform to the Ohio Department of Transportation (ODOT) specifications.

5.7 Pavement Drainage

Based on the poorly-drained nature of the cohesive subgrade soil areas, it is anticipated that surface water infiltration may collect in the aggregate base course. Without adequate drainage, water will remain in the base for extended periods of time, creating localized wet, soft pockets. The presence of these pockets will increase the likelihood that pavement distress (cracking, potholes, etc.) will develop. Drainage features may include grading the subgrade surface to slope downward to the outside edge of pavements and/or providing longitudinal edge drains connected to storm sewers or other outlets. A system of “finger drains” could also be installed near catch basins within the pavement areas to collect surface water, thus reducing the potential for freeze-thaw effects on the pavement.

5.8 Groundwater Control and Drainage

Groundwater observations and readings are summarized in Section 4.3. Based on the data available, such as the soil characteristics, moisture conditions encountered in the borings, and site conditions, it is our opinion that the “normal” groundwater level will generally be encountered at depths on the order of 8 to 10 feet. However, Diligent dewatering operations should be anticipated for excavations that extend deeper than 4 feet below existing grade due to the potential for perched water in the sandy silt soils.

It is our experience that adequate control of groundwater seepage, perched water, or surface water run-off into shallow excavations in predominantly cohesive profiles should be achievable by minor dewatering systems, such as pumping from prepared sumps. In the event excessive seepage is encountered during construction, CT may be notified to evaluate whether other dewatering methods are required.

5.9 Excavations and Slopes

The sides of temporary excavations for building foundations, utility installations, and other construction should be adequately sloped to provide stable sides and safe working

conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable Occupational Safety and Health Administration (OSHA) safety standards must be followed.

The soils encountered during this investigation, within the anticipated depths of excavation, consist of the following OSHA Type soils:

- OSHA Type C soils (existing fill materials, granular soils, and cohesive soils with unconfined compressive strengths less than 1,000 psf).

For temporary excavations in Type A, B, and C soils, side slopes must be no steeper than $\frac{3}{4}$ horizontal to 1 vertical ($\frac{3}{4}$ H:1V), 1H:1V, and 1½H:1V, respectively. For situations where a higher strength soil is underlain by a lower strength soil and the excavation extends into the lower strength soil, the slope of the entire excavation is governed by that required by the lower strength soil. **In all cases, flatter slopes may be required if lower strength soils or adverse seepage conditions are encountered during construction.**

For permanent excavation slopes, we recommend that grades be no steeper than 3H:1V without a more extensive geotechnical evaluation of the proposed construction plans and site conditions.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 Site and Subgrade Preparation

Prior to proceeding with construction operations, topsoil, root mats, vegetation, and other deleterious non-soil materials should be removed from the proposed construction areas. Suitable topsoil may be stockpiled for later use in landscape areas. Topsoil thicknesses may vary across the site. Dark soils having the appearance of topsoil, but exhibiting only root “hairs” or trace organics less than approximately five percent, may not require stripping for the full depth of the darkly colored zone, provided the subgrade can be satisfactorily proof rolled as described below. Conversely, the site may contain areas where additional excavation will be required beyond the darkly colored zone due to organics or high moisture in order to provide a stable subgrade for construction. It should be noted that the topsoil thicknesses at the site may vary from those referenced in the borings, and the actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

Due to the perched water condition and marginal soils encountered at this site consideration should be given to installing site utilities early in the site preparation work. Often time early installation of underground utilities helps in lowering the ground water conditions and reduces the quantity of subgrade remediation required.

The proof rolling and preparation of this site will require careful inspection. Voids remaining after utility trench abandonment, removal of foundations from previous development, as well as other exposed excavations should be backfilled with engineered fill, placed in controlled lifts and tested for suitable compaction in accordance with the criteria in Section 6.2 of this report. If such excavations are randomly filled or graded without compaction control, excessive settlement could occur.

Based on the conditions encountered in the borings, the soils are anticipated consisted of predominantly cohesive soils. Upon completion of stripping and clearing, the areas intended to support floor slabs or new fill should be carefully inspected by a geotechnical engineer. At that time, the engineer should observe proof rolling of the cohesive soil and clayey sand

subgrades utilizing a 20- to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. If granular fill materials are used to raise grades, proof rolling/compaction of these soils should be performed utilizing a vibratory smooth drum roller. The truck should make a minimum of two passes covering the proposed development area, with additional passes as necessary to achieve required compaction and/or subgrade stabilization.

The purpose of the proof-rolling operations for the cohesive soils is to locate any weak, soft, loose, or excessively wet materials that may be present at the time of construction. The purpose of vibratory compaction for the granular soils is to densify zones of loose materials that are encountered in the upper portion of the soil profile, thereby providing more uniform subgrade support. We recommend a roller with a minimum dead weight on the drums of 8 tons, vibrating at 30 Hz or greater, and traveling at speeds not exceeding approximately 4 feet per second (about 3 miles per hour). These operational criteria should provide sufficient dynamic compaction energy to alleviate loose soil conditions within the zone of influence for subgrade support.

Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted fill or stabilized in place utilizing conventional remedial measures such as discing, aeration, and recompaction.

Once the site has been proof rolled, inspected, and stabilized, the proof-rolled or inspected subgrades should not be exposed to wet conditions. It should be recognized that during periods of wet weather, the clayey soils that will be exposed at design subgrades will tend to pond water for short periods of time, with the potential to deteriorate the prepared subgrade.

The results of the inspection and proof-rolling operations will be partially dependent on construction operations, the moisture content of the soil, and the weather conditions prevalent at the time. If pumping or rutting is encountered and difficulty is experienced in the operation of construction equipment, CT should be notified in order to determine which method of subgrade modification may be best suited for the conditions encountered. Should such conditions be experienced, we may recommend that a small test area be used

to determine the necessary depth of undercutting and stone replacement or other remedial action necessary to achieve a stable subgrade condition.

6.2 Fill

Material for engineered fill or backfill required to achieve design grades may consist of any non-organic soils having a maximum dry density as determined by the Standard Proctor (ASTM D 698) of 90 pounds per cubic foot (pcf) or greater. On-site soils may be used as engineered fill materials provided that they are free of organic matter, debris, excessive moisture, and rock or stone fragments larger than 3 inches in diameter. All fill placed at or within 12 inches of floor slab elevations should consist of ODOT A-6b, or better soils to maintain suitable use of the recommended design CBR value included in this report.

Depending on seasonal conditions, the on-site soils may be wet of optimum and may require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill.

Fill should be placed in uniform layers no more than 8 inches thick (loose measure) and adequately keyed into stripped and scarified soils. All fill within the pavement subgrades should be compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor).

The upper soil profile at the site consists of predominantly native cohesive soils. The contractor should be prepared to use a sheepsfoot roller to provide effective compaction of the cohesive soils. If imported granular soils are utilized as engineered fill, a vibratory smooth-drum roller should be utilized for compaction. In narrow utility or footing excavations, the on-site cohesive soils may be difficult to compact; therefore, a clean granular material may be required in these areas.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities

be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

6.3 Foundation Excavations

As mentioned in Section 5.1, foundation excavations should have a detailed inspection performed for each foundation. A geotechnical engineer or qualified representative should perform these inspections to verify that the exposed materials are similar to those encountered in the borings and that engineered fill has been properly placed and compacted such that it is capable of supporting the design bearing pressure.

We recommend that the foundation excavations be concreted as soon as practical after they are excavated and that water not be allowed to pond in any excavation. If it is necessary to leave the bearing surface open for any extended period of time, we recommend that a thin mat of lean concrete be placed over the bottom of the excavation to reduce damage to the surface from weather or construction. Foundation concrete should not be placed on frozen or saturated subgrade.

Additional foundation subgrade inspection and preparation recommendations are provided in Section 5.1.

7.0 QUALIFICATION OF RECOMMENDATIONS

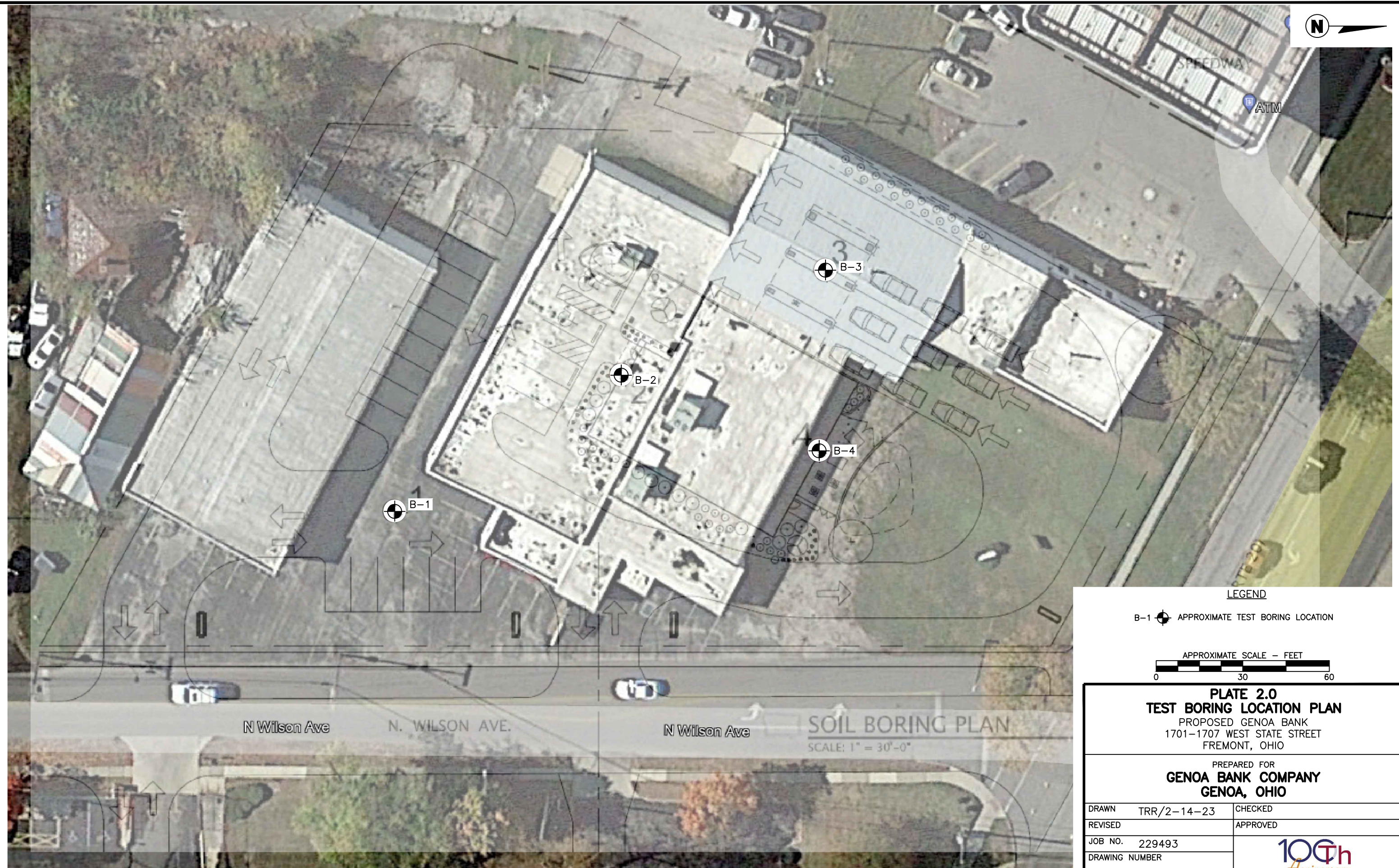
Our evaluation of foundation and floor slab design and construction conditions has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. This is especially true for previously developed sites. Therefore, experienced geotechnical engineers should observe earthwork and foundation construction to confirm that the conditions anticipated in design are noted. Otherwise, CT assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, a qualified geotechnical engineer should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.


The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. CT is not responsible for the conclusions, opinions, or recommendations of others based on this data.

PLATES



LEGEND

B-1  APPROXIMATE TEST BORING LOCATION

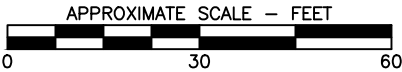


PLATE 2.0
TEST BORING LOCATION PLAN
PROPOSED GENOA BANK
1701-1707 WEST STATE STREET
FREMONT, OHIO

PREPARED FOR
GENOA BANK COMPANY
GENOA, OHIO

DRAWN TRR/2-14-23

CHECKED

REVISED

APPROVED

JOB NO. 229493

DRAWING NUMBER

229493-02G



FIGURES



CT Consultants
1915 N 12th St
43604
Telephone: 419-324-2222

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT	Genoa Bank Company	PROJECT NAME	Proposed Genoa Bank
PROJECT NUMBER	229493 (TTL No. 2333401)	PROJECT LOCATION	Fremont, Ohio
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	2-1/4 in. HSA	GROUND ELEVATION	
DATE STARTED	1/25/23	COMPLETED	1/25/23
LOGGED BY	KKC	CHECKED BY	LGH
NOTES			
GROUND WATER LEVELS:		▽ AT TIME OF DRILLING 6.0 ft	
		AT END OF DRILLING None	
		0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		ASPHALT FRAGMENTS with CRUSHED STONE - 5 Inches						
			Moist Soft Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 1	78	2-2-2 (4)	1.50		21
			Moist Loose Brown SILTY, CLAYEY SAND (SC-SM)	SS 2	89	2-2-5 (7)	NP		22
			Moist Loose Brown SILTY SAND (SM)	SS 3	100	3-4-6 (10)	NP		25
			Moist Soft Stiff Gray SILTY CLAY w/Sand (CL-ML)	SS 4	100	4-3-2 (5)	NI		26
	10		Bottom of hole at 10.0 feet.						



CT Consultants
1915 N 12th St
43604
Telephone: 419-324-2222

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT	Genoa Bank Company	PROJECT NAME	Proposed Genoa Bank
PROJECT NUMBER	229493 (TTL No. 2333401)	PROJECT LOCATION	Fremont, Ohio
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	2-1/4 in. HSA	GROUND ELEVATION	
DATE STARTED	1/25/23	COMPLETED	1/25/23
LOGGED BY	KKC	CHECKED BY	LGH
NOTES			
GROUND WATER LEVELS:		▽ AT TIME OF DRILLING 5.0 ft	
		AT END OF DRILLING None	
		0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		ASPHALT FRAGMENTS with CRUSHED STONE - 14 Inches						
	1.2'		Moist Very Soft to Soft Brown LEAN CLAY w/Trace Sand (CL)	SS 1	56	2-1-2 (3)	NI		20
	2.0'		Moist Soft Brown SILTY CLAY w/Sand (CL-ML)						
	5		Moist Medium Stiff to Stiff Brown SANDY SILT (ML)	SS 2	89	1-2-2 (4)	0.25	103	23
	8.8'		Moist Soft Gray SILTY CLAY w/Trace Sand (CL-ML)	SS 3	100	2-4-6 (10)	NI		26
	10			SS 4	100	2-2-2 (4)	NI		25
	15			SS 5	100	1-1-2 (3)	0.50		27
	20		@18.2': w/Sand and Trace Gravel	SS 6	100	1-1-1 (2)	0.50		32
	20.0'		Bottom of hole at 20.0 feet.						



CT Consultants
1915 N 12th St
43604
Telephone: 419-324-2222

BORING NUMBER B-3

PAGE 1 OF 1

CLIENT	Genoa Bank Company	PROJECT NAME	Proposed Genoa Bank
PROJECT NUMBER	229493 (TTL No. 2333401)	PROJECT LOCATION	Fremont, Ohio
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	2-1/4 in. HSA	GROUND ELEVATION	
DATE STARTED	1/25/23	COMPLETED	1/25/23
LOGGED BY	KKC	CHECKED BY	LGH
NOTES			
GROUND WATER LEVELS:		▽ AT TIME OF DRILLING 3.0 ft	
		▼ AT END OF DRILLING 12.0 ft	
		0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0								20 40 60 80
			ASPHALT FRAGMENTS with CRUSHED STONE - 4 Inches						
			FILL - Moist Medium Stiff Brown SILTY CLAY w/Sand and Trace Crushed Stone	SS 1	67	5-4-3 (7)	1.50		20
			Moist Soft Brown SANDY SILT (ML)	SS 2	89	2-1-2 (3)	NI		27
			Moist Medium Stiff Brown SANDY SILT (ML)	SS 3	100	2-3-3 (6)	0.25		26
			Moist Very Soft to Soft Brown/Gray SILTY CLAY w/Sand (CL-ML)	SS 4	100	2-1-2 (3)	0.14	104	27
			Moist Soft Gray SANDY SILT (ML)	SS 5	100	2-1-2 (3)	0.25		27
	15.0'		Bottom of hole at 15.0 feet.						



CT Consultants
1915 N 12th St
43604
Telephone: 419-324-2222

BORING NUMBER B-4





















PAGE 1 OF 1

CLIENT	Genoa Bank Company	PROJECT NAME	Proposed Genoa Bank
PROJECT NUMBER	229493 (TTL No. 2333401)	PROJECT LOCATION	Fremont, Ohio
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	2-1/4 in. HSA	GROUND ELEVATION	
DATE STARTED	1/25/23	COMPLETED	1/25/23
LOGGED BY	KKC	CHECKED BY	LGH
NOTES			
GROUND WATER LEVELS:		▽ AT TIME OF DRILLING 4.7 ft	
		AT END OF DRILLING None	
		0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch	







ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		ASPHALT - 8 Inches						
			Moist Very Soft to Soft Brown SILTY CLAY w/Trace Sand and Organics (CL-ML)	SS 1	33	2-1-2 (3)	NI		22
	5		@4.7': Very Soft, w/Sand	SS 2	89	2-1-1 (2)	NI		29
			Moist Medium Stiff Brown SILTY CLAY w/Sand (CL-ML)	SS 3	100	2-3-3 (6)	0.47	105	24
	10		Moist Very Soft to Soft Gray SILTY CLAY w/Sand (CL-ML)	SS 4	100	2-2-2 (4)	0.24	101	27
	15		@13.5': w/Trace Sand	SS 5	100	2-1-1 (2)	0.25		29
	20		@18': w/Sand and Trace Gravel	SS 6	100	1-1-1 (2)	0.25		29
	25		Bottom of hole at 25.0 feet.	SS 7	100	2-1-2 (3)	0.25		21

LEGEND KEY

Unified Soil Classification System Soil Symbols

	GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.		GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.		GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.		GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.
	SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.		SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.		SM - SILTY SAND Includes Sand-Silt mixtures.		SC - CLAYEY SAND Includes Sand-Clay mixtures.
	ML - SILT Includes Silt with Sand and Sandy Silt.		CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.		MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.		CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.
	CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.		OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.		OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.		Pt - PEAT Includes humus, swamp and other soils with high organic content.
	FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.		TOPSOIL		ASPHALT - Bituminous Asphalt		CONCRETE - Includes broken concrete rubble.

Sample Symbols

	SS - Split Spoon		ST - Shelby Tube		RC - Rock Core		GS - Geoprobe Sleeve
			AU - Auger Cuttings		GB - Grab		

Notes:

1. Exploratory borings were drilled on January 25, 2023, using 2¼-inch inside diameter hollow-stem augers.
2. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.
3. The test borings were located in the field by CT Consultants, Inc. based on plan provided by Duket Architects Planners.
4. Unconfined Compressive Strength (tsf):
NI = Not Intact
NP = Non-Plastic

PROJECT: Proposed Genona Bank - Fremont, Ohio					TTL Associates, Inc.					PROJECT NO: 2333401								
TABULATION OF TEST DATA																		
Boring Number	Summary Number	Summary Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)	Organic Content (% of Dry Weight)	Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	SS-1	1.0 - 2.5		4	21.3		3,000 *		1	3	2	19	22	53	37	19	18	CL
	SS-2	3.5 - 5.0		7	22.5													
	SS-3	6.0 - 7.5		10	25.4													
	SS-4	8.5 - 10.0		5	25.6													
B-2	SS-1	1.0 - 2.5		3	20.2													
	SS-2	3.5 - 5.0		4	22.9	103.5	505											
	SS-3	6.0 - 7.5		10	26.4													
	SS-4	8.5 - 10.0		4	25.0													
	SS-5	13.5 - 15.0		3	27.3		1,000 *											
	SS-6	18.5 - 20.0		2	32.2		1,000 *											
B-3	SS-1	1.0 - 2.5		7	20.2		3,000 *											
	SS-2	3.5 - 5.0		3	26.9													
	SS-3	6.0 - 7.5		6	26.1		500 *											
	SS-4	8.5 - 10.0		3	26.7	104.0	290											
	SS-5	13.5 - 15.0		3	26.6		500 *											

PROJECT: Proposed Genona Bank - Fremont, Ohio					TTL Associates, Inc.					PROJECT NO: 2333401								
TABULATION OF TEST DATA																		
Boring Number	Summary Number	Summary Interval Depth (Feet)	Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)	Organic Content (% of Dry Weight)	Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification	
								Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index		
B-4	SS-1	1.0 - 2.5	3	21.8														
	SS-2	3.5 - 5.0	2	28.5														
	SS-3	6.0 - 7.5	6	24.5	104.7	935												
	SS-4	8.5 - 10.0	4	26.5	101.3	485												
	SS-5	13.5 - 15.0	2	29.0		500 *												
	SS-6	18.5 - 20.0	2	29.4		500 *												
	SS-7	23.5 - 25.0	3	20.6		500 *												



CT Consultants
1915 N 12th St
43604
Telephone: 419-324-2222

GRAIN SIZE DISTRIBUTION

CLIENT Genoa Bank Company

PROJECT NAME Proposed Genoa Bank

PROJECT NUMBER 229493 (TTL No. 2333401)

PROJECT LOCATION Fremont, Ohio

