BESSOLO
DESIGN GROUP, INC
ARCHITECTURE ▪ INTERIORS ▪ ENGINEERING
License #AA-C002117

OHA TO #18 – REEVES COURT

NEW ROOF/HVAC

COMMISSION #: 23002.00

PROJECT SPECIFICATIONS
VOLUME 1

FEBRUARY 2024

1 Beach Drive SE, Suite 201M ▪ St. Petersburg, Florida 33701
(727) 894-4453 ▪ (727) 896-8662

OHA TO18 REEVES COURT
UNIT 1743/1745 RENOVATION
PROJECT MANUAL

TABLE OF CONTENTS

February 2024

KEM
ENGINEERS, INC
MECHANICAL • ELECTRICAL • STRUCTURAL
LICENSE #EB-0007103
Robert Mark Spencer, P.E. #85672

DIVISION 15 – MECHANICAL

KEM
ENGINEERS, INC
MECHANICAL • ELECTRICAL • STRUCTURAL
LICENSE FL #EB-0007103
Fredrick Smith, P.E #88980

DIVISION 16 – ELECTRICAL

SECTION 00100
INSTRUCTIONS TO BIDDERS

PART 1- GENERAL

DESCRIPTION OF WORK

HUD Form 5369 "Instruction to Bidders for Contracts – Public and Indians Housing Programs," pages 1 through 4, dated Oct. 2002 follow this Section and are incorporated into the Contract Documents.

See Section 00110 "Supplementary Instructions to Bidders" for modifications to HUD Form 5369.

END OF SECTION

SECTION 00110
SUPPLEMENTARY INSTRUCTION TO BIDDERS

PART I – GENERAL

1.01 SCOPE

A. This Section sets forth the modifications and additions to Section 00100 "Instructions to Bidders" HUD Form 5369.

B. In those instances that a clause is amended, modified, voided, or superseded, the provisions of such Clause not specifically amended, modified, voided or superseded shall remain in effect. Should a conflict exist between the provisions of the Agreement, and those of the Specifications, the requirements of the Agreement shall apply.

1.02 MODIFICATIONS AND ADDITIONS

A. Clause 2, add the following subclause (C): "(C) Contractor must submit questions concerning interpretations and bidding in writing to: Bessolo Design Group, Contact: Project Architect, 1 Beach Drive SE, Suite 201M., St. Petersburg, FL 33701 (727.894.4453)/ph or (727) 896-8662 fax).

B. Clause 12, Indian Preference Requirements: Delete Clause 12 in its entirety.

END OF SECTION

SECTION 00300

BID PROPOSAL FORM

PROPOSAL FORM
(Submit in quadruplet on Contractor's Letterhead)

DATE:
TIME:

For: OHA – Reeves Court – New Roof/HVAC

Gentlemen:

The undersigned, hereinafter called "Bidder," having visited the site of the proposed project and familiarized himself with the local conditions, nature and extent of the Work, and having examined carefully the Drawings, Specifications, the Form of Agreement, and other Contract Documents with the Bond requirements therein, proposes to furnish all labor, materials, equipment and other items, facilities, and services for the proper execution and completion of _____, in full accordance with the Advertisement for Bid, Invitation to Bid, Instructions to Bidders, and all other documents relating thereto, on file in the office of _____ and, if awarded the Contract, to complete the said Work within the time limits specified or stipulated herein for the following Bid price.

Base Bid: _____

Dollars $ _____

With foregoing as a Base Bid, the following cost of alternate proposals are submitted in accordance with the drawings and specifications.

The Bidder hereby agrees that:

a. The above proposal shall remain in full force and effect for a period of ninety (90) calendar days after the time and date of receipt of Bids and that this Bidder will not revoke or cancel this proposal or withdraw from the competition within the said ninety (90) calendar days.
b. In case he be notified in writing by mail, telegraph, or delivery of the acceptance of this proposal within ninety (90) days after the time set for the opening of bids, the undersigned agrees to execute within ten (10) days a formal written contract for the work for the above stated compensation and at the time to furnish and deliver to the Owner a Performance Bond and a Payment Bond in accordance with the requirements of the Supplementary General Conditions of the Contract, both in an amount equal to 100% of the contract sum or shall assure completion per Clause 10 of HUD- Form 5369. The premium for such bond will be paid by the Prime Contractor.
c. The undersigned agrees to commence actual physical work on the site with an adequate force and equipment within ten (10) calendar days of the date of receipt of written notice to commence and to complete fully all work within ____ consecutive calendar days from and including said date.
d. Enclosed herewith is a bid bond in the amount of _____ Dollars ($) (being not less than 5% of the Base Bid). The undersigned agrees that the above stated amount is the proper measure of liquidated damages, which the Owner will sustain by the failure of the undersigned to execute the contract and to furnish the Performance Bond and Payment Bond in case this proposal is accepted, and further agrees to the following: *If this proposal is accepted within ninety (90) after the date set for the opening of bids and the undersigned fails to execute the contract within ten (10) days after notice of such acceptance or if he fails to furnish both Performance Bond and Payment Bond, and proper insurance, the obligation of the bid bond will remain in full

force and effect and money payable thereon shall be paid into the funds of the Owner as liquidated damages for such failures; otherwise, obligation of the Bond will be null and void.

*If the Contractor should fail, for reasons other than enumerated in General Condition HUD Form 5370, Clause 32, "Default" and other applicable clauses subsequently determined as nonjustifiable by the Owner to complete the project by the stipulated time, then the Contractor shall hereby agree as condition on this contract to pay to the Owner, amounts in accordance with the following, not as a penalty but as liquidated damages for such breach of contract, for each calendar day that the Contractor shall be in default after stipulated date.

LIQUIDATED DAMAGES _____

The above amount is agreed upon as a proper measure of liquidated damages which Owner will sustain per day, by failure of Contractor to complete work at stipulated time and is not construed in any penalty.

Attached is a fully and truthfully executed form HUD-5369, "Representation, Certifications, and other Statements of Bidders – Public and Indian Housing Programs."

Attached is an affidavit in proof that the undersigned has not entered into any collusion with any person in respect to this proposal or any other proposals for the contract for which this proposal is submitted.
Attached is a Sworn Statement Pursuant to Section 287.133 (3)(a), Florida Statues, on Public Entity Crimes.

Note: The penalty for making false statements in offer is prescribed in 18 U.S.C. 1001.

This total base price includes all sitework and general construction, electrical and mechanical work shown and called for by the drawings and specifications.

GUARANTEED MAXIMUM PRICE BREAKDOWN:

The undersigned further states that the Guaranteed Maximum Price noted above, when broken down, is comprised of the following costs for the _____ (does not include any of the Alternate Prices), which are not for the addition to or deletion from the Base Bid. The breakdown is required for the bid to be considered complete.

DIVISION 1 – GENERAL CONDITIONS $_____
(Provide separate detail page)

DIVISION 2 – SITEWORK

02070	Selective Demolition	$_____
02282	Termite Control	$_____
02821	Asbestos Abatement	$_____
	Other Division 2 Work (provide detail page)	$_____
	DIVISION 2 – TOTAL	$_____

DIVISION 3 – Concrete $_____

03010	Concrete Repair and Maintenance	$_____
03100	Concrete Formwork	$_____
03200	Concrete Reinforcement	$_____
03300	Cast-In-Place Concrete	$_____
03930	Concrete Rehabilitation	$_____
	Other Division 3 Work (provide detail page)	$_____
	DIVISION 3 – TOTAL	$_____

DIVISION 4 – Masonry

04200	Unit Masonry	$_____
04225	Masonry, Mortar, CMU	$_____
	Other Division 4 Work (provide detail page)	$_____
	DIVISION 4 – TOTAL	$_____

DIVISION 5 – Metals – Not Used $_____

DIVISION 6 – Wood & Plastics – Not Used

DIVISION 7 – Thermal & Moisture Protection

07211	Thermal Insulation	$ _____
07250	Weather Resistant Barriers	$ _____
07311	Fiberglass Shingles	$ _____
07620	Sheet Metal Flashing & Trim	$ _____
	Other Division 7 Work (provide detail page)	$_____
	DIVISION 7 – TOTAL	$_____

DIVISION 8 – Doors & Glass

08160	Molded Composite Interior Doors	$_____
	Other Division 8 Work (provide detail page)	$_____

DIVISION 8 – TOTAL $_____

DIVISION 9 – Finishes

09256 Tiling $_____
09912 Interior Paint and Coatings $_____
Other Division 9 Work (provide detail page) $_____

DIVISION 9 – TOTAL $_____

DIVISION 10 – Specialties $_____

10307 Fire Extinguishers $_____
Other Division 10 Work (provide detail page) $_____

DIVISION 10 – TOTAL $_____

DIVISION 11 – Equipment $_____

11400 Residential Appliances $_____
Other Division 11 Work (provide detail page) $_____

DIVISION 11 – TOTAL $_____

DIVISION 12 – Furnishings

12511 Horizontal Louver Blinds $_____
Other Division 12 Work (provide detail page) $_____

DIVISION 12 – TOTAL

DIVISION 13 – Special Construction – Not Used

DIVISION 14 – Conveying Systems – Not Used

DIVISION 15 – Mechanical (Sections 15010-15715)

Common Work for Plumbing $_____
Plumbing excluding fixtures $_____
Plumbing Fixtures $_____
Plumbing Piping Systems $_____
Other Division 15 Work (provide detail page) $_____

DIVISION 15 – TOTAL $_____

DIVISION 16 – Electrical

16010 Supplementary General Conditions $_____
16142 Electrical Connections for Equipment $_____
16441 Load Centers $_____
16450 Grounding $_____
Other Division 16 Work (provide detail page) $_____

DIVISION 16 – TOTAL $_____

FEE $_____

INSURANCE $_____

PAYMENT AND PERFORMANCE BOND $_____

TOTAL GUARANTEED MAXIMUM BASE BID **$**_____

ALTERNATES

The Undersigned proposes the following alternate prices for work more fully described in the Contract Documents. It is understood that the Owner shall accept or reject the alternates as his own best interests shall determine. All alternates noted with "(Price Required): are to be completed for the Bid Proposal to be considered complete. None of the alternate Prices are to be included in the Guaranteed Maximum Base Bid Price. All alternate prices are to include full compensation for the work including overhead and profit.

ALTERNATE NO. 1: (Price Required)

The additional cost to provide and install a ducted return air for the air conditioning system for each residence. The cost for the ducted return shall not be included in the base bid price.

ALTERNATE NO. 2: (Price Required)

Cost to provide and install underground electric service to each residence in lieu of the overhead service shown. The cost for the underground electric service is not to be included in the Base Bid.

ALTERNATE NO. 3: (Price Required)

_____

ADD/DEDUCT $_____

ALTERNATE NO. 4: (Price Required)

_____

ADD/DEDUCT $_____

BID ACCEPTANCE:
In submitting this proposal, the undersigned understands that the right is reserved by the Architect to reject any and all bids or parts thereof and to waive any informalities, defects or irregularities in the bids, as may be deemed in its best interest. If written notice of acceptance of this proposal is mailed, telegraphed, faxed, or delivered to the undersigned within forty-five (45) days after the opening thereof, or at any time thereafter before this Proposal is withdrawn, the undersigned agrees to execute and deliver the Contract in the prescribed form and furnish a Performance and Payment Bond, each in a sum equal to 100% of the total contract price, and the policies of insurance or certificates of insurance within seven (7) days after the Contract is executed by the Owner.

TIME OF COMPLETION:

We, the undersigned agree to commence with construction within _ calendar days after signing a Contract, and to complete the project within _____ calendar days after Notice To Proceed from the Owner. Contract includes _____ days of inclement weather. Time is of the essence in this project, and the contract will provide that if the

contractor fails to commence work and complete the project in the time frame stated above, or an approved extension thereof, the contractor shall pay to the Owner as fixed, agreed and liquidated damages, but not as a penalty, the sum of $300.00 for each calendar day of delay.

We, the undersigned, acting through its authorized officers and intending to be legally bound, agree that this Bid Proposal shall constitute an offer by the undersigned to enter into a contract with the acts and things therein provided, which offer shall be irrevocable for a period of 60 calendar days from the date of the opening hereof and that the Owner may accept this offer at any time during said period by notifying the undersigned of the acceptance of said offer. To the extent the period specified herein is in excess of any period specified by law for award of contract, submissions of this Proposal constitutes the written consent of the undersigned to an extension of time for award of the contract to the end of such period.

ADDENDA:

The undersigned agrees that the following addenda, which have been issued during the bidding period, have been received and have been considered both before and in the preparation of this proposal.

Addendum No. _____dated _____

Addendum No. _____dated _____

Addendum No. _____dated _____

CONTRACTOR'S STATEMENTS OF BID QUALIFICATION:
ADDRESS, LEGAL STATUS AND SIGNATURE OF BIDDER:
The undersigned Bidder does hereby designate the address given below as the legal address to which all notices, directions, or other communications shall be served or mailed.

The undersigned in submitting this proposal to Bessolo Design Group, Inc., and in consideration of receipt and consideration of this proposal by Bessolo Design Group, Inc., intends to be legally bound by this proposal.

The undersigned Bidder does hereby declare that the Bidder has the legal status checked below:

_____ Individual _____ Partnership

_____Corporation incorporated under the laws of_____.

Attached is the M.B.E. Utilization Summary 00710, page 4.

Florida Construction Industries Licensing Board Certification.

_____ _____
(Name of Holder) (Certificate no.)

In witness whereof, the bidder has hereunto set this signature and affixed his seal this _____day of_____, 202___ AD.

(CORPORATE SEALED IF BIDDER IS A CORPORATION)

BIDDER: _____
NAME

BY: _____
NAME

_____
TITLE

_____
Witness (Secretary's Attest)
if Bidder is Corporation

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. The project consists of renovation of single story side by side duplex family residence building, 3 units total, #1743 and #1745 duplex (2 units)

1. Project Location: 1743 and 1745 E. South Street, Orlando, FL

B. The work consists of providing new roof system as well as new HVAC system. Relocate all electrical and plumbing systems within the attic space after new roof in place. Replace plumbing fixtures in same locations. All walls and doors shall be repainted.

1.03 COORDINATION OF WORK

A. Work of the contractor and subcontractors: provide in the following manner for interrelated portions of the project, unless specifically indicated otherwise on the drawings or elsewhere in these specifications.

B. Work by contractor

1. Provide structural openings, and chases for piping and ductwork, as established, and set by the mechanical and electrical subcontractors. Provide lintels, when required.
2. Build in bolts, brackets and hangers, and similar items for work established by the mechanical and electrical subcontractors.
3. Frame around and provide openings, including required lintels, for ductwork. Provide concrete equipment bases, where these are indicated on the drawings, including those shown on mechanical and electrical drawings.
4. Provide curb and flashing for mechanical units not furnished with factory-built curbs. Provide and build in flashings for mechanical units with factory-built curbs installed by mechanical subcontractors.
5. Provide required painting of mechanical and electrical equipment except shop coat and factory finishes.

C. Work by mechanical subcontractor (HVAC, plumbing and fire protection):

1. Arrange and pay for all inspections and tests of piping systems, required by governing authorities and these specifications.
2. Furnish detailed drawings and location lines for concrete bases for mechanical equipment.
3. Provide anchor bolts and other inserts required.
4. Furnish location lines and dimensional data for field fabricated roof curbs.
5. Furnish and install pre-engineered, prefabricated curbs for mechanical equipment.

6. Furnish concrete bases required for proper installation of the mechanical equipment when not shown on the drawings.
7. Cooperate with the contractor in laying out portions of the work requiring correlation of systems for esthetic effect, such as ceilings, wall paneling, and similar items.
8. Mechanical equipment and controls electrical coordination: see sections 15010 and 16010.
9. Furnish and install all fire dampers where required by code.
10. Complete all fire caulking of system components through fire rated assemblies.

D. Work by electrical subcontractor:

1. Provide motor starters complete with auxiliary contacts where required for the function of the mechanical system unless specifically noted otherwise on the drawings or in the mechanical specifications.
2. Verify wiring requirements with mechanical specifications for motor driven equipment. Provide complete wiring for the equipment except controls and required interlocking.
3. Provide concrete bases required for proper installation of electrical equipment when not shown on the drawings.
4. Cooperate with the contractor in laying out portions of the work requiring correlation of systems for aesthetic effect, such as ceilings, wall paneling, and similar items.
5. All control wiring set forth in the control diagrams on the drawings shall be furnished and installed by electrical subcontractor under the supervision of the control manufacturer's representative.
6. Mechanical equipment and controls electrical coordination: see Sections 16010 and 15010.
7. Complete fire caulking of all system components through fire rated assemblies.

E. Openings, sleeves and chases:

1. Contractor shall provide miscellaneous openings, and built in sleeves, as required throughout the building for the various trades.
2. Contractors or subcontractors requiring the building in of such items shall locate for, and provide such items to the contractor. If walls, floors or ceilings are already built, the subcontractor or contractor requiring such items shall provide such items in a manner approved by the architect.

1.04 COMMENCEMENT OF WORK

A. Preparation: Properly prepare work to receive subsequent work or finish. Notify Architect if any work is unsatisfactory to receive subsequent work or finish and receive instruction before proceeding.

1.05 LAYOUT OF WORK

A. Execution: The Contractor shall employ, or have in his employ, a competent Engineer who shall establish a permanent bench mark and general reference points, to which easy access may be had by all the Contractors and Subcontractors, for use in determining all levels, lines and grades and for verification from time to time during the progress of the work. It is the duty of each Contractor or Subcontractors to lay out his own work, take his own measurements, grades and levels, and be responsible for their

proper correlation to the entire project, except that the Contractor shall lay out the partitions on the forms or rough floors as a guide to the Trades.

B. Coordination: Report inconsistencies between the Drawings and the actual size to the Architect and receive instructions before commencing work.

1.06 USE OF SITE

A. Contractor may utilize the portion of the site designated by the Owner at the time of the pre-construction meeting.

1.07 WORK SEQUENCE

A. The various phases of the work shall be executed in the following sequence, unless the Architect receives express permission of the Owner to permit specific variations requested by the Contractor.

1.08 OWNER FURNISHED ITEMS

A. The following is a list of the items which shall be furnished by the Owner and installed by the Contractor:

B. The following is a list of the items, which shall be furnished and installed by the Owner. Rough-ins and all final connections are by the General Contractor.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01035
MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1. Multiple Prime Contracts: Provisions of this Section apply to the work of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
3. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
4. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
5. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.03 MINOR CHANGES IN THE WORK

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

1.04 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
2. Within 20 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
    a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

B. Contractor-Initiated Proposals: When latent or unforseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

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

1.05 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in the purchase amount only where indicated as part of the allowance.
2. When requested, prepare explanations and documentation to substantiate the margins claimed.
3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 21 days.

1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

1.06 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

1.07 CHANGE ORDER PROCEDURES

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

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01040
COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

1.03 RELATED SECTIONS

A. Division 1 Section "Field Engineering" specifies procedures for field engineering services, including establishment of benchmarks and control points.

B. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and preinstallation conferences.

C. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.

D. Division 1 Section "Materials and Equipment" for coordinating general installation.

E. Division 1 Section "Contract Closeout" for coordinating contract closeout.

1.04 COORDINATION

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

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

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project closeout activities.

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.05 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1. Show the relationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
   1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.02 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

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

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

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

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. This Section includes administrative and procedural requirements for cutting and patching.

1.03 RELATED SECTIONS

A. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.04 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Owner requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.

1.05 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
   a. Foundation construction.
   b. Bearing and retaining walls.
   c. Structural concrete.
   d. Structural steel.
   e. Lintels.
   f. Timber and primary wood framing.
   g. Structural decking.
   h. Stair systems.
   i. Miscellaneous structural metals.
   j. Exterior curtain-wall construction.
   k. Equipment supports.
   l. Piping, ductwork, vessels, and equipment.
   m. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
   a. Primary operational systems and equipment.
   b. Air or smoke barriers.
   c. Water, moisture, or vapor barriers.
   d. Membranes and flashings.
   e. Fire protection systems.
   f. Noise and vibration control elements and systems.
   g. Control systems.
   h. Communication systems.
   i. Conveying systems.
   j. Electrical wiring systems.
   k. Operating systems of special construction in Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.
   a. Processed concrete finishes.
   b. Stonework and stone masonry.
   c. Ornamental metal.
   d. Matched-veneer woodwork.
   e. Preformed metal panels.
   f. Firestopping.
   g. Window wall system.

h. Stucco and ornamental plaster.
i. Acoustical ceilings.
j. HVAC enclosures, cabinets, or covers.

1.06 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

B. Plaster: Comply with ASTM C 842.
1. Base Coat: Ready-mixed, sand aggregate gypsum plaster base.
2. Finish Coat: Ready-mixed gypsum finish plaster.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

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

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

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

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

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

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

D. Plaster Installation: Comply with manufacturer's instructions and install thickness and coats as indicated.

1. Unless otherwise indicated, provide 3-coat work.
2. Finish gypsum plaster to match existing adjacent surfaces. Sand lightly to remove trowel marks and arrises.
3. Cut, patch, point-up, and repair plaster to accommodate other construction.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. General: This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:

1. Land survey work.
2. Civil-engineering services.
3. Damage surveys.
4. Geotechnical monitoring.

1.03 RELATED SECTIONS

A. Division 1 Section "Coordination" for procedures for coordinating field engineering with other construction activities.

B. Division 1 Section "Submittals" for submitting Project record surveys.

C. Division 1 Section "Project Closeout" for submitting final property survey with Project Record Documents and recording of Owner-accepted deviations from indicated lines and levels.

1.04 SUBMITTALS

A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.

B. Final Property Survey: Submit 10 copies of the final property survey.

C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Submittals" and "Project Closeout" Sections.

1.05 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in the state where the Project is located, to perform required land-surveying services.

B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the state where the Project is located, to perform required engineering services.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 EXAMINATION

A. Identification: The Owner will identify existing control points and property line corner stakes.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.02 PERFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

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

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

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

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

1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey."

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 SECTION INCLUDES

A. Submittal Procedures and Schedule.

B. Construction progress schedules.

C. Proposed products list.

D. Shop drawings.

E. Product Data.

F. Samples.

G. Manufacturers' instructions.

H. Manufacturers' certificates.

I. Construction photographs.

1.03 RELATED SECTIONS

A. Section 01400 - Quality Control: Manufacturers' field services and reports.

B. Section 01700 – Contract Closeout: Contract warranty and manufacturers' certificates Closeout certificates.

1.04 SUBMITTAL PROCEDURES

A. Transmit each submittal with Architect/Engineer accepted form.
   1. Submit a schedule of submittals in accordance with Section 1.07.

B. Sequentially number the transmittal forms. Resubmittals to have original number with Alphabetic sequence.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and Detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimension, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents. All submittals without this stamp of approval or which have not been checked, or only superficially checked, will not be considered and will be returned to the Contractor for resubmission.

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

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

G. Provide space for Contractor and Architect/Engineer review stamps.

H. Revise and resubmit submittals as required, identify all changes made since previous submittal.

I. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
    a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
    b. If an intermediate submittal is necessary, process the same as the initial submittal.
    c. Allow 2 weeks for reprocessing each resubmittal.
    d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

K. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by *5* inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.
    a. Project name.
    b. Date.
    c. Name and address of the Architect.
    d. Name and address of the Contractor.
    e. Name and address of the subcontractor.
    f. Name and address of the supplier.

g. Name of the manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.

L. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

1.05 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within 15 days after date of Owner-Contractor Agreement for Architect/Engineer review. Include the anticipated amount of each monthly payment that will become due to the Contractor in accordance with the Progress Schedule/

B. Revise and resubmit as requested by the Architect.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version. No application for payment will be approved until the initial or revised schedule has been received and approved by the architect.

D. Submit a horizontal bar chart with separate line for each major section of Work, identifying first work day of each week.

E. 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.

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

G. Indicate Submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner.

1.06 PROPOSED PRODUCTS LIST

A. Within 30 days after date of Owner-Contractor Agreement, 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.

1.07 SUBMITTAL SCHEDULES

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.

2. Prepare the schedule in chronological order. Provide the following information:
   a. Scheduled date for the first submittal.
   b. Related Section number.
   c. Submittal category (Shop Drawings, Product Data, or Samples).
   d. Name of the subcontractor.
   e. Description of the part of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.08 SHOP DRAWINGS

A. Contractor shall prepare and submit to the Architect 30 days after award of the Contract a schedule of Shop Drawings and Submittals as required in the Contract Documents. Schedule shall fix dates for submission, and the lead time for each submittal as related to the requirements for return receipt. No work shall be fabricated by the Contractor, save at his own risk, until approval of the shop drawings has been obtained.

B. After review, distribute in accordance with Article on Procedures above and for Record Documents described in Section 01700 – Contract Closeout.

C. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by II inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
7. Final Submittal: Submit 4 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Architect for distribution. The Architect will retain 1 print and return the remainder.
   a. Alternately, submissions may be sent electronically except for samples for various materials and color selection.
8. At contractor's option, electronic files may be submitted in lieu of hard copy prints. Electronic submittal shall be submitted with the same information as listed above and in Section 1.04 above.

9. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.09 PRODUCT DATA

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

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. After review, distribute in accordance with Article on Procedures above and for Record Documents described in Section 01700 – Contract Closeout.

1.10 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Submit samples of finishes from the full range of manufacturers' standard colors in custom colors, textures, and patterns for Architect/Engineer.

C. Include identification on each sample, with full Project information.

D. Submit the number or samples specified in individual specification sections; one of which will be retained by Architect/Engineer.

E. Reviewed samples, which may be used in the Work, are indicated in individual specification Sections.

1.11 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, (start-up,) adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.12 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification sections, submit manufacturers' certificate to Architect/Engineer for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.13 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "No Exception Taken," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Architect marks a submittal "Furnish as Corrected," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
   a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
4. Returned for Resubmittal: When the Architect marks a submittal “Rejected,” do not proceed with any work covered by this submittal, including purchasing, fabrication, delivery or any other activity. This submittal does not comply with the Contract Documents or Specifications.
5. Restricted Release: When the Architect marks a submittal “Submit Specified items,” work covered by the submittal may proceed provided it complies with the Contract Documents and the Specifications are submitted for Architect review.
6. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

C. Unscheduled Submittals: The Architect will return unscheduled submittals to the sender without action.

1.14 CONSTRUCTION PHOTOGRAPHS

A. Each month submit photographs to Architect/Engineer with Application for Payment.

B. Photograph: Prints; color; 8 x 10 inch; mounted on 8-1/2 x 11 inch soft card stock, with left edge binding margin for three hole punch.

C. Take two (2) aerial site photographs from differing directions indicating the relative progress of the Work, ten (10) days maximum prior to submitting Application for Payment.

D. Identify photographs with date, time orientation and project identification.

PART 2 – PRODUCTS - Not Used

PART 3 – EXECUTION - Not Used

END OF SECTION

SECTION 01631
SUBSTITUTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
3. Division 1 Section "Materials and Equipment" specifies requirements governing the Contractor's selection of products and product options.

1.03 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:

1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
2. Revisions to the Contract Documents requested by the Owner or Architect.
3. Specified options of products and construction methods included in the Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.04 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.

1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
   b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
   c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
   d. Samples, where applicable or requested.
   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, if any in the Contract Sum.
   g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
   h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
   a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents.
   3. The request is timely, fully documented, and properly submitted.

4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
11. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

C. Forms: Used as part of the requirements of this section are attached at the end of this section and are as follows:
1. Proposed Equal Substitution Form, (2) Pages

PART 3 - EXECUTION

Not Used

END OF SECTION

Proposed Equal Substitution Form

Project:_____

Title: _____

To: _____

Re: _____

From: _____

Date: _____

Project Number:

Contract For:

Specification Title: Description:

Section: Page: Article/Paragraph:

Proposed Substitution:

Manufacturer:_____ Address:_____ Phone:_____

Trade Name: Model No.:

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by:_____ Signed by:_____

Firm:_____ Address:_____ Telephone:_____

A/E's REVIEW AND ACTION
- □ Substitution approved - Make submittals in accordance with Specification Section 01331.
- □ Substitution approved as noted - Make submittals in accordance with Specification Section 01331.
- □ Substitution rejected - Use specified materials.
- □ Substitution Request received too late - Use specified materials.

Signed by: Date:
Supporting Data Attached: Drawings Product Data Samples Tests Reports

Note: Tenderers are advised that consideration will only be given to "or equal" substitution proposals which are accompanied by technical product data sufficient to facilitate an objective review by the evaluation team. Required technical data includes information described

Proposed Equal Substitution Form

Note: Tenderers are advised that no voluntary option for any product will be reviewed by the evaluation team unless the Tenderer submitting the voluntary option also provides a bid price on a product which is either the "basis of design", or a specified equal product, or a substitute product which in fact meets with the requirements of an "Equal Substitution".

Specification Title: Description: _____

Section: Page: Item ID: _____

Proposed Voluntary Option: _____

Manufacturer: Address: Phone: _____

Trade Name: Model No.: _____

Installer: Address: Phone: _____

History: New product 2-5 years old 5-10 years old More than 10 years old
Differences between voluntary option and specified product:
Point-by-point comparative data attached
Reason for not providing specified item:

Similar Installation:
Project: Architect: _____
Address: Owner: _____
Date Installed: _____

Proposed Voluntary Option affects other parts of Work: No Yes; explain

Savings to Owner for accepting Voluntary Option: ($).

Supporting Data Attached: Drawings Product Data Samples Tests Reports

Note: Tenderers are advised that consideration will only be given to "or equal" substitution proposals which are accompanied by technical product data sufficient to facilitate an objective review by the evaluation team. Required technical data includes information described on each item page and that which is required by section 01631. Burden to demonstrate technical compliance with the furnished specifications lies with the Tenderer.

The Undersigned certifies:

- Proposed voluntary option has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed voluntary option will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted voluntary option which may subsequently become apparent are to be waived.
- Proposed voluntary option does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the voluntary option.
- Coordination, installation, and changes in the Work as necessary for accepted voluntary option will be complete in all respects.

Submitted by:_____ Signed by:_____

Firm:_____ Address:_____ Telephone:_____

SECTION 01650
STARTING OF SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.03 RELATED SECTIONS

A. Section 01400 – Quality Control: Manufacturers field reports.

B. Section 01700 – Contract Closeout: System operation and maintenance data and extra materials.

1.04 STARTING SYSTEMS

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

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

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, 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 completed and tested.

F. Execute start-up under supervision of responsible Contractor's personnel in accordance with manufacturers' instruction.

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

H. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.05 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 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 scheduled times, at equipment location.

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

1.06 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 Section 15990.

C. Reports will be submitted by the independent firm 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.

D. The mechanical and electrical sub-contractors shall conduct 3-month, 6-month and 9-month inspections, following the Substantial Completion of Construction, for preventative maintenance purposes. These first year warranty inspection reports shall be submitted in written form to the Owner/Architect within ten (10) days of inspection.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

1.03 RELATED SECTIONS

A. Section 01650 - Starting of Systems: System start-up, testing, adjusting, and balancing.

B. Section 01730 - Operation and Maintenance Data.

C. Section 01740 - Warranties and Bonds.

1.04 CLOSOUT 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 shall include the following:

1. Record Drawings
2. Operation and Maintenance Data
3. Guarantees, Warranties and Bonds
4. Keys and Keying Schedule
5. Spare Parts and Maintenance Materials
6. Certificate of Insurance for Products and Completed Operations
7. Certificate of Occupancy, if required

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.05 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Replace filters of operating equipment.

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

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

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

1.06 ADJUSTING

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

1.07 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. Manufacturers' name and product model and number
2. Product substitutions or alternates utilized

E. Record Documents and Shop Drawings: legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish ground 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. The Contractor shall submit to the Architect/Engineer, four (4) weeks before final inspection, an electronic copy of operating and maintenance data in a single PDF file for review. All data shall be assembled and completely indexed into one volume and shall identify the size, model, and features indicated for each item.

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.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.02 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1 Section "Construction Facilities and Temporary Controls."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
   a. Remove labels that are not permanent labels.

b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION

SECTION 01731
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Division 01 Section "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
2. Division 01 Section "Execution" for final property survey.
3. Division 01 Section "Closeout Procedures" for general closeout procedures.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.03 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit 1 set(s) of marked-up record drawings and specifications.
2. Number of Electronic Copies: Submit copies of record Drawings as follows:
   a. Final Submittal:
      1) Submit 1 paper-copy set(s) of marked-up record drawings.
      2) Submit PDF electronic files of scanned record drawings.

B. Record Product Data: Submit 1 paper copy and annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit 1 paper copy and annotated PDF electronic files and directories of each submittal.

D. Reports: Submit written report [**weekly**] indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.02 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.03 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01732
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:

1. Divisions 02 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.04 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit 2 copies within 7 days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
   a. Name of Project.
   b. Name and address of videographer.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.05 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01, Section 01301 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.06 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least 7 days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, a written or a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
   a. Name of Contractor/Installer.
   b. Business address.
   c. Business phone number.
   d. Point of contact.
   e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.
   a. Produce segments to present a single significant piece of equipment per segment.
   b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
   c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
   1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 SECTION INCLUDES

A. Preparation and submittal

B. Time and schedule of submittals

1.03 RELATED SECTIONS

A. Document 00701 – General Conditions: Performance Bond and Labor and Material Payment Bonds, Warranty, and Correction of Work.

B. Section 01700 – Contract Closeout

C. Section 01730 – Operation and Maintenance Data.

D. Individual Specifications Sections: Warranties required for specific products or Work.

1.04 FORM OF SUBMITTALS

A. Bind in commercial quality, 8-1/2 x 11 inch three ring side binders with hardback, cleanable plastic covers.

B. Label cover of each binder with typed or printed title, "WARRANTIES AND BONDS", with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible principal.

C. Table of contents: Neatly typed, in the sequence of the Table of Contents of the Project manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or Work item.

D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

1.05 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.06 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) days after acceptance.

B. Make other submittals within ten (10) days after Date of Substantial Completion, prior to final Application for Payment.

C. For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within ten (10) days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01805
CLEANING UP

PART I – GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including the General, Supplementary General Conditions and special conditions shall apply to the Work specified in this section.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Volatile waste shall be stored in covered metal containers, and removed from the premises daily.

B. Clean-up and disposal operations shall be conducted to comply with local ordinances and Anti-Pollution Laws.

1. Burning or burying of rubbish and waste on the site is not permitted.
2. Disposal of volatile fluid waste in storm or sanitary sewer systems, or into streams or waterways is not permitted.

C. Hazardous materials shall be stored and disposed of only as permitted by law and shall be properly and legally removed from the premises prior to the completion of the Contract.

1.03 MATERIALS

A. Cleaning materials shall be used on materials only when recommended specifically by the materials manufacturer.

1.04 CLEANING DURING CONSTRUCTION

A. The Contractor shall oversee cleaning by the various trades and ensure that the building and grounds are maintained free from accumulations of waste materials. The premises shall be kept free from the accumulation of waste materials or rubbish at all times, daily cleaning required.

B. The Contractor shall provide suitable containers on the Site for collection of waste disposed of in a legal manner.

C. The Contractor shall not, in any case, use the Owner's trash facilities.

1.05 FINAL CLEANING

A. At completion of the Project, and just prior to Final Acceptance, the Contractor and Owner shall conduct an inspection of the entire Project. Prior to conducting this inspection the Contractor shall clean, or re-clean, entire areas exposed to view to normal level for "first class" maintenance/cleaning of building projects of a similar nature, as needed to produce a "clean" condition as judged by the Architect and Owner. The Contractor shall at minimum:

1. Remove grease, dust, dirt, stains, temporary labels, and fingerprints, non-permanent protection and other foreign materials from interior and exterior surface.
2. Repair, patch, and touch-up marred surfaces to match adjacent finishes.
3. Broom clean paved surfaces, clean and rake site, and clean other exposed site finishes.

B. The Contractor shall maintain cleaning while the Project is occupied by the Owner.

C. The Contractor shall remove all his/her waste materials and rubbish from and about the project as well as all tools, construction equipment, and machinery and surplus materials.

END OF SECTION

SECTION 02070
SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This Section includes the following:

1. Demolition and removal of selected portions of a building.
2. Demolition and removal of selected site elements.
3. Patching and repairs.

1.03 RELATED SECTIONS

A. Division 1 Section "Summary of Work" for use of the building and phasing requirements.

B. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.

C. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.

D. Division 1 Section "Contract Closeout" for record document requirements.

E. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.

F. Division 2 Section "Site Clearing" for site clearing and removing above- and below-grade improvements.

G. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

H. Division 6 Section "Rough Carpentry" for material and construction requirements for temporary enclosures.

I. Division 9 Section "Gypsum Board Assemblies" for material and construction requirements for temporary enclosures.

J. Division 15 Sections for cutting, patching, or relocating mechanical items.

K. Division 16 Sections for cutting, patching, or relocating electrical items.

1.04 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

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

1.05 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.

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

1. Cooperate with Owner's archaeologist or historical adviser.

1.06 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

H. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

I. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.07 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

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

C. Predemolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section "Project Meetings."

1.08 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

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

C. Asbestos: It is not expected that asbestos will be encountered in the Work. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner.

1. Asbestos will be removed by Owner before start of Work.

D. Asbestos: Asbestos is present in the building to be selectively demolished. A report on the presence of asbestos is on file for review and use. Examine the report to become aware of locations where asbestos is present.

1. Asbestos abatement is specified elsewhere in the Contract Documents.
2. Do not disturb asbestos or any material suspected of containing asbestos except under the procedures specified elsewhere in the Contract Documents.

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

1.09 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.10 WARRANTY

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

PART 2 - PRODUCTS

2.01 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.01 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 the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

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

3.02 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

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

a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

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

C. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

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

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
6. Cover and protect furniture, furnishings, and equipment that have not been removed.

E. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 3 5/8-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

F. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

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

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

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

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

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

3.05 SELECTIVE DEMOLITION

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.
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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents

of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment throughout the structure 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. On-site storage or sale of removed items is prohibited.
10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

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

D. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Remove no more existing roofing than can be covered in one day by new roofing. See applicable Division 7 Section for new roofing requirements.

F. Remove air-conditioning equipment without releasing refrigerants.

3.06 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Division 1 Section "Cutting and Patching."

C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.

D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

E. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.

1. Closely match texture and finish of existing adjacent surface.

2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

F. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will be permitted only at designated areas on Owner's property, providing required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

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

3.08 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

3.09 SELECTIVE DEMOLITION SCHEDULE

A. Remove the following:

B. Remove and salvage the following:

C. Remove and reinstall the following:

END OF SECTION

SECTION 02282
TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This Section includes soil treatment for termite control.

1.03 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and application instructions.

C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.04 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.05 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.06 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Equil Adonis 75 WSP Insecticide by Envincio LLC
2. DemonMax by Syngent Crop Protection, Inc.
3. Premise Pro insecticide by Bayer Environmental Science

C. Dilute with water to concentration level recommended by manufacturer.

D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.01 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
   a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
   b. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. (6.1 L of chemical solution per sq. m) to areas where fill is washed gravel or other coarse absorbent material.
   c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench for each 12 inches (300 mm) of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches (150 to 200 mm) wide along outside of foundation to a depth of not less than 12 inches (300 mm). Punch holes to top of footing at not more than 12 inches (300 mm) o.c. and apply chemical

solution. Mix chemical solution with the soil as it is being replaced in the trench.

2. Under crawlspace and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures.

3. Treat soil under or around crawlspace structures as follows:
   a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawlspaces.
   b. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench, for each 12 inches (300 mm) of depth from grade to footing, along outside of foundation walls, including part beneath entrance platform porches, etc.
   c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) along the inside and outside of foundation walls of porches.
   d. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) of soil surface as an overall treatment only where attached concrete platform and porches are on fill or ground.

4. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet 2.6 L per meter, poured directly into the hollow spaces.

5. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet (5.1 L per linear m) of penetration.

C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION

SECTION 02821
ASBESTOS ABATEMENT

PART 1 - GENERAL

Perform all operations in connection with asbestos abatement, encapsulation, removal and related work as shown on drawings and/or specified herein.

A. RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

B. DESCRIPTION OF WORK

Removal;
Black Flooring Adhesive
Black & Yellow Adhesive

Enclosure;
See attach OHC Environmental Engineering Report dated December 2019

Special Precautions:

Coordinate with the Owner's Project Representative for the shutdown and isolation of all electrical circuits and air movement systems within the regulated area from that of the rest of the facility to prevent any inconvenience to building occupants and contamination outside of the regulated area. Refer to Article entitled: "Preparation of Regulated Area," of this section relative to shutdown of mechanical and electrical systems.

Equipment that must remain in operation while abatement work is in progress consists of the following:

Restoration: Contractor is responsible for restoring all existing finish surfaces to their original state, which were damaged as a result of abatement activities.

References

C. REFERENCES

All work under this contract shall be done in strict accordance with all applicable General and State regulations, standards and codes governing asbestos abatement and any other trade work done in conjunction with the abatement.

The most recent edition of any relevant regulation in force at the time of bid opening shall be in effect. Where conflict among the laws, rules, and regulations or with these specifications exists the most stringent requirements shall be utilized.

The Contractor shall make available, in the clean change area of the worker decontamination system, copies of this specification and all standards, regulations, and codes listed hereinafter.

Specific Reference:

Occupational Safety and Health Administration (OSHA):

Title 29 Code of Federal Regulations, Section 1910.134(d) -

Title 29 Code of Federal Regulations, Section 1926.1101- Construction Industry, including the mandatory appendices;

Appendix A - OSHA Reference Method.

Appendix C - Qualitative and Quantitative Fit Testing Procedures.

Appendix D - Medical Questionnaires.

Appendix E - Interpretation and Classification of Chest Roentgenograms.

Nonmandatory appendices:

Appendix B - Detailed Procedures for Asbestos, Tremolite, Anthrophyllite, and Actinolite Sampling and Analysis.

Appendix F - Work Practices and Engineering Controls for Major Asbestos Removal, Renovation, and Demolition Operations.

Appendix G - Work Practices and Engineering Controls for Small Scale, Short Duration Asbestos Renovation and Maintenance Activities.

Appendix H - Substance Technical Information for Asbestos.

Appendix I - Medical Surveillance Guidelines for Asbestos, Tremolite, Anthrophyllite, and Actinolite.

Title 29 Code of Federal Regulations, Section 1926.59 - Hazard Communication Standard. Requires employers to inform their workers of the hazards of any chemicals used on the project and to train their employees in proper safeguards.

Environmental Protection Agency (EPA): Title 40 Code of Federal Regulations (CFR) Part 763 Subpart G - Asbestos Abatement Projects; worker Protection (effective March 27, 1987).

Environmental Protection Agency (EPA) Title 40 Code of Federal Regulations (CFR) Part 61 - National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule effective November 20, 1990.

Department of Health Services (DHS) State of Wisconsin Administrative Rule, Chapter DHS 159, Asbestos Certification and Training.

Department of Natural Resources (DNR) State of Wisconsin Administrative Rule, Chapter NR 447,Control of Asbestos Emissions.

Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human Respiration", and Specification G-7.1 "Commodity Specification for Air".

Department of Natural Resources (DNR) State of Wisconsin Administrative Rule Chapter NR 506, Landfill Operations Criteria for Disposal of Asbestos Containing Material.

D. QUALIFICATIONS

The prospective Contractor who is proposed to actually perform the asbestos abatement work, shall submit to the Architect/Engineer the data hereinafter requested within ten (10) days after Bid Opening. The proposed asbestos abatement Contractor will be awarded a Contract, only if data submitted is determined to be favorable in all instances, by the Architect/Engineer, and the prospective Contractor further meets the qualifications requirements specified in the Instructions to Bidders.

The proposed asbestos abatement Contractor shall, if requested:

Demonstrate prior experience on asbestos abatement projects of similar nature and scope of that being bid, through the submission of letters of reference from building owners including the name, address, and telephone numbers of the contact persons who are specifically familiar with the referenced projects. At least three previous users of this service shall be submitted. Include descriptions of projects and records of all air monitoring data that was generated during the projects.

Submit a description of all major Asbestos Abatement Equipment owned by the prospective Contractor which is available for use on this project such as:

Respiratory protection equipment.

HEPA vacuum equipment.

Negative air pressure equipment.

Spray equipment for amended water.

Equipment used for shower facilities in decontamination enclosure system.

Submit a list of names, work responsibilities and evidence of certification for all employees that will be assigned to this project:

At least one firm principal, the firm's "competent person" and any other personnel performing supervisory duties must be certified by the Wisconsin Department of Health Services as having successfully completed a comprehensive 5-day course for Asbestos Abatement Contractors and Supervisors in conformance with Wisconsin Administrative Code DHS 159.

Contractor's employees who perform asbestos abatement activities must be certified by the Wisconsin Department of Health Services as having successfully completed a comprehensive 4-day course for Asbestos Abatement Workers in conformance with Wisconsin Administrative Code DHS 159.

E. **DEFINITIONS**

ACGIH: American Conference of Governmental Industrial Hygienists

AIHA: American Industrial Hygiene Association

Air Monitoring: The process of measuring the fiber content of a known volume of air collected during a specific period of time shall conform with Appendix A to OSHA 29 CFR 1926.1101 The procedure normally utilized for asbestos follows the NIOSH Standard Analytical Method 7400 for Asbestos in Air. For clearance air monitoring, electron microscopy methods may be utilized for lower detectability limit and specific fiber identification.

Air Sampling Professional: The Professional contracted or employed by the Division to supervise and conduct air monitoring and analysis schemes. This individual shall not be affiliated in any way other than through this contact with the Contractor performing the abatement work.

ANSI: American National Standards Institute

Asbestos: Means the asbestiform varieties of chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite-grunerite); tremolite; anthrophyllite, and actinolite.

Asbestos Containing Material (ACM): Material composed of asbestos of any type and in an amount greater than 1%, either alone or mixed with other fibrous or nonfibrous materials.

Asbestos Containing Waste Material: Asbestos containing material or asbestos contaminated objects requiring disposal.

ASTM: American Society for Testing and Materials

Authorized Visitor: The Building Owner (and designated representatives) and any representative of a regulatory agency having jurisdiction over the project.

Certified Industrial Hygienist (CIH): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

Competent Person: Means an employee of the asbestos abatement contractor who is capable of identifying existing asbestos hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them pursuant to OSHA 1926.1101(b).

Decontamination Enclosure: A decontamination system consisting of a clean room, a shower room, and an equipment room separated from each other and from the regulated area by airlocks. This system is used for all workers to enter and exit the regulated area and may also serve as equipment and waste pass out on small jobs.

Department of Natural Resources (DNR): A Wisconsin state agency that is responsible for enforcement of Chapter NR 447.

Encapsulation: The application of a bridging or penetrating liquid material to asbestos containing materials to control the release of asbestos fibers into the air. The bridging liquid material creates a membrane over the surface and the penetrating liquid material seeps through the surface and binds all components together.

Enclosure: The construction of an airtight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.

EPA: U. S. Environmental Protection Agency

Glovebag Technique: A method with limited applications for removing small amounts of friable asbestos-containing material from ducts, short piping runs, valves, joints, elbows, and other nonplanar surfaces in a noncontained (plasticized) regulated area. The glovebag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains all asbestos fibers released during the process.

HEPA Filter: A high efficiency particulate air filter capable of removing particles 0.3 microns in diameter with 99.97% efficiency.

HEPA Vacuum: A vacuum system equipped with HEPA filtration.

NESHAPS: National Emission Standards for Hazardous Air Pollutants

NIOSH National Institute for Occupational Safety and Health

OSHA: Occupational Safety and Health Administration

Permissible Exposure Limits (PEL): No personnel associated with asbestos abatement work shall be exposed to an airborne concentration of asbestos in excess of the following limits, as determined by the method prescribed in Appendix A to OSHA 29 CFR 1926.1101, or by an equivalent method:

P.E.L. is 0.1 fiber per cubic centimeter of air as an eight (8) - hour time-weighted average.

Excursion Limit (EL) is 1.0 fiber per cubic centimeter of air as averaged over a sampling period of thirty (30) minutes.

Regulated Area: An area identified by specific boundaries where airborne concentrations of asbestos exceed, or can reasonably be expected to exceed the P.E.L. and/or Excursion Limit. The regulated area may take the form of:

A temporary negative-pressure enclosure, or

An area specifically identified and segregated in any manner that minimizes the number of employees exposed to asbestos.

Surfactant: A chemical wetting agent added to water to improve penetration.

Visible Emissions: Any emissions containing particulate asbestos material that is visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with water and afterwards thoroughly decontaminated or disposed of as asbestos contaminated waste.

F. **SUBMITTALS AND NOTICES**

The Contractor shall submit a completed Asbestos/Lead Abatement Certification (Form #DOA-4509) no later than the end of the seventh calendar day after the bid opening date.

Prior to Commencement of Work, Contractor shall:

File a "Notification of Demolition and/or Renovation Form 4500-113" with the parties named hereinafter, when required, at least 10 working days prior to commencement of demolition or renovation project involving any asbestos-containing material.

Air Management Asbestos Coordinator
Department of Natural Resources
P.O. Box 7921
Madison WI 53707-7921

File an "Asbestos Project Notification Form 00041" with the parties named hereinafter, when required, at least 2 working days prior to commencement of renovation project involving any asbestos-containing material.

Department of Health Services
Asbestos/Lead Section, Room 137
P.O Box 2659
Madison, WI 53701-2659

Submit the following documentation attached to completed form DOA-4523 prior to commencing work:

Manufacturer's information and MSDS or SDS for the mastic remover that the Contractor intends to use for floor tile mastic removal. Mastic remover shall be low odor and shall not contain known carcinogens.

A copy of the asbestos training certification card issued by Wisconsin Department of Health and Family Services pursuant to DHS 159 for all Contractor employees that will be working on the project.

Submit the following documentation at completion of the work:

Copies of all completed “Transportation and Disposal Manifest” forms for all asbestos waste materials removed from the regulated area during the abatement process.

Project Log per DHS 159.21(2)

Occupant Protection Plan per DHS 159.21(3).

During Abatement Activities, Contractor shall submit to the Owner's Project Representative, if requested:

Shop drawings for layout and construction of decontamination enclosure systems and barriers for isolation of the regulated area as detailed in this specification and required by applicable regulations. If work is to be phased, a phasing schedule shall also be submitted.

Weekly (or as required) job progress reports detailing abatement activities. Include review of major problems and action taken, injury reports, equipment breakdown.

Logs documenting filter changes on respirators, HEPA vacuums, negative pressure ventilation units, local exhaust ventilation systems, and other engineering controls.

Results of bulk material analysis and air sampling data collected during the course of the abatement including OSHA compliance air monitoring results.

Results of materials testing conducted during the abatement for purposes of utilization during abatement activities (e. g., testing of encapsulant for depth of penetration, testing of materials for adherence to encapsulated surfaces).

Contractor shall post at the entrance to the regulated area a list containing the names, addresses, and telephone numbers of the Contractor, Fire Department and any other personnel who may be required to be contracted during abatement activities.

G. **SITE SECURITY**

Contractor shall be responsible for the security of the regulated area(s) during abatement operations in order to protect work efforts and equipment.

The regulated area shall be restricted to only authorized, trained, and protected personnel. These may include the Contractor's employees, employees of subcontractors, state representatives, and any other designated individuals. A list of authorized personnel shall be established prior to job start and posted in the clean room of the decontamination facility.

Contractor shall immediately decontaminate (if required) and evict any unauthorized individual entering the regulated area and notify the Construction Representative of action taken and identity of the unauthorized individual.

A log book shall be maintained in the clean room area of the decontamination system. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry.

Access to the regulated area shall be through a single decontamination system located where shown on approved Shop Drawings. All other means of access (doors, windows, hallways, etc.) shall be blocked or locked so as to prevent entry to or exit from the regulated area. The only exceptions to this rule are the waste pass-out air lock which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits in case of fire or accident. Emergency exits shall not be locked from the inside; however, they shall be sealed with polyethylene sheeting and tape until needed.

H. **EMERGENCY PLANNING**

Written emergency plan shall be submitted through the Owner's Project Representative and approved by the Architect/Engineer prior to the initiation of abatement activities.

Emergency procedures shall be in written form and prominently posted in the clean change area and equipment room of the worker decontamination area. Everyone prior to entering the regulated area must read and sign these procedures to acknowledge receipt and understanding of work site layout, location of emergency exits and emergency procedures.

Emergency planning shall include notification of police, fire and emergency medical personnel of planned abatement activities, work schedule and layout of regulated area, particularly barriers that may affect response capabilities.

Emergency planning shall include considerations of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces and heat related injury. Written procedures shall be developed and employee training in procedures shall be provided.

Employees shall be trained in evacuation procedures in the event of workplace emergencies under the following conditions:

For non-life-threatening situations, employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the workplace to obtain proper medical treatment.

For life-threatening injury or illness, worker decontamination shall take least priority. After measures to stabilize the injured worker, remove the worker from the workplace and secure proper medical treatment.

Telephone numbers of all emergency response personnel shall be prominently posted in the clean change area and equipment room, along with the location of the nearest telephone.

I. **PRECONSTRUCTION MEETING**

The Contractor shall attend a preconstruction meeting to be conducted at a time and place designated by the Owner's Project Representative. All parties having an active role in asbestos abatement shall be in attendance.

The Contractor, Contractor's competent person and other supervisory personnel who shall provide on-site direction of the abatement activities must attend.

At this meeting the Contractor shall provide all documentation as required by Article entitled: "Submittals and Notices," herein. In addition, the Contractor shall be prepared to provide detailed information concerning:

Preparation of regulated area.

Personal protective equipment including respiratory protection and protective clothing.

Employees who will participate in the project, including delineation of experience, training, certification, and assigned responsibilities during the project.

Decontamination procedures for personnel, regulated area and equipment.

Abatement methods and procedures to be utilized.

Required air monitoring procedures.

Procedures for handling and disposing of waste materials.

Procedures for final decontamination and cleanup.

A sequence of work and performance schedule.

Procedures for dealing with heat stress.

Emergency procedures.

Methods of adhering plastic sheeting to the surfaces to be covered.

Delivery, Storage and Handling

J. **DELIVERY, STORAGE AND HANDLING**

Deliver all materials in the original packages, containers or bundles bearing the name of the manufacturer and the brand name.

Damaged, deteriorating or previously used materials shall not be used and shall be removed from the work site and disposed of properly.

PART 2 - PRODUCTS

A. MATERIALS

Polyethylene sheeting for walls and stationary objects shall be a minimum of four (4) mil thick. For floors and all other uses, sheeting of at least six (6) mil thickness shall be used in widths selected to minimize the frequency of joints.

Polyethylene sheeting utilized for decontamination enclosure shall be opaque white or black in color.

Flame retardant polyethylene sheeting shall be utilized when working near heat sources.

Hardboard or plywood, minimum 1/4 inch thick, shall be furnished to protect finished floor surfaces, such as carpet or hardwood floors, to prevent damage from scaffolds or falling objects. Such protection shall also be provided for polyethylene sheeting under the scaffold area if the material being removed has sharp projections which could readily puncture the enclosure material.

Disposal bags shall be of six (6) mil polyethylene, preprinted with labels as required by OSHA Requirement 29 CFR 1926.1101 (k) (8).

Disposal drums for transporting disposal bags shall be metal or fiberboard with locking ring tops.

Stick-on labels as per EPA, OSHA or DNR requirements shall be present on disposal containers.

Surfactant (Wetting Agent):

For use with materials containing asbestos identified as "Amosite", shall be a 50/50 mixture of polyoxyethylene ether and polyoxyethylene ester, mixed in a proportion of one (1) fluid ounce to five (5) gallons of water or as specified by manufacturer.

For all materials containing asbestos identified as "chrysotile", "crocidolite", or types other than Amosite, shall consist of soapy water mixed in a proportion of two (2) fluid ounces of liquid soap to five (5) gallons of water.

Asbestos Removal Encapsulant (substitute for surfactant): In lieu of using a wetting agent in water to control airborne fibers, an asbestos removal encapsulant may be used.

Encapsulating Material:

Bridging type encapsulant (for sealing masonry and concrete walls, barrier surfaces during cleanup phase and asbestos containing surfaces to remain in place) shall be capable of being applied with airless spray equipment, able to withstand light impact or abrasion without releasing fibers, water insoluble when cured, and must retain sufficient integrity after six (6) years to allow recoating.

Penetrating type encapsulant (for sealing scratch coat plaster, wood grounds and wood blocking which have been in contact with asbestos containing material and also exposed ends of pipe insulation) shall not be noxious or toxic to applicator or subsequent occupants, shall have high flame retardance and low toxic fume and smoke emission ratings, and shall have some permeability to water vapor to prevent condensation accumulation.

B. **EQUIPMENT**

Negative Pressure Ventilation Units:

A sufficient quantity of negative pressure ventilation units equipped with HEPA filtration and operated in accordance with ANSI Z9.2-79 (local exhaust ventilation requirements) and EPA guidance document EPA 560/5-83-002 Guidance for Controlling Friable Asbestos-Containing Material in Buildings Appendix F: Recommended Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement shall be utilized so as to provide one workplace air change every 15 minutes.

To calculate total air flow requirement:

$$\text{Total } Ft^3/\text{Min.} = \frac{\text{Volume of Regulated area (in } Ft^3)}{15 \text{ Min.}}$$

To calculate the number of units needed for the abatement:

$$\text{Number of Units Needed} = \frac{\text{Total } Ft^3/\text{Min.}}{0.75 \text{ (Capacity of Unit in } Ft^3/\text{Min.)}}$$

The air filtering equipment shall be capable of filtering asbestos fibers at 0.3 um at 99.9 percent efficiency. Prefilters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of prefiltration are required. The first-stage prefilter shall be a low efficiency type (e.g., for particles 10 um and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 um). Prefilters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.

Exhaust air from the regulated area shall maintain a negative pressure of 0.02 inches of water (head). The ventilation shall operate on a 24 hours basis throughout the abatement process until final clearance has been approved.

Air Purifying Respirators:

Respirator bodies shall be of half face or full face type with removable cartridges. Single use, disposable or quarter face respirators shall not be used. Full face respirators shall be equipped with a nose cup or other anti fogging devices as would be appropriate for use in air temperatures less than 32 degrees F.

Filter cartridges shall, at a minimum, be HEPA type filters certified by NIOSH under 30 CFR Part 11 or with filters certified for particulates under 42 CFR Part 84.

Full body disposable protective clothing, including head, body and foot coverings consisting of material impenetrable by asbestos fibers (Tyvek^{R} or equivalent) shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing.

Additional safety equipment, such as hard hats, eye protection, safety shoes, disposable PVC gloves, as necessary, shall be provided to all workers and authorized visitors. Safety Equipment shall meet latest ANSI Standards.

Nonskid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.

Provide sufficient supply of disposable mops, rags and sponges for work area decontamination.

Provide scaffolds, ladders, lifts and hand tools such as scrapers, wire cutters, brushes, utility knives, wire saws, as the work requires.

Sprayers with pumps capable of providing 14-15 pounds per square inch (psi) at the nozzle tip at a flow rate of 2 gallons per minute for spraying amended water.

Rubber dust pans and rubber squeegees shall be provided for cleanup.

Brushes utilized for removing loose asbestos containing material shall have nylon or fiber bristles, not metal.

A sufficient supply of HEPA filtered vacuum systems shall be available during cleanup.

Airless spray equipment with an adjustable low pressure nozzle shall be provided for spraying encapsulants. Nozzle tip size and pressure adjustment shall conform to encapsulant manufacturers written recommendations.

Heavy duty power cables for temporary electrical service and a portable electric generator for maintaining negative pressure in the work area shall be present in case of power failure.

Warning Signs and Labels: As required by OSHA Regulation 29 CFR 1926.1101(k).

Other equipment the Contractor deems necessary for asbestos abatement work shall be submitted to the Architect/Engineer for approval prior to its use.

PART 3 - EXECUTION

A. GENERAL COMPLIANCE MEASURES

Mandatory Protection Conditions: Contractor's employees shall wear appropriate respiratory protection and protective clothing under the following conditions:

During installation or implementation of engineering work practices and control measures.

During maintenance and repair activities for which control measures, hereinafter described, are not feasible.

Whenever the control measures are not yet sufficient to reduce exposure below the Permissible Exposure Limits (TWA and/or Excursion Limits).

Whenever emergency conditions exist.

Control Measures: The Contractor shall use one or any combination of the following control methods to achieve compliance with the "Permissible Exposure Limits" defined hereinbefore:

Local exhaust ventilation equipped with HEPA filter dust collection systems.

General dilution ventilation equipped with HEPA filtration systems on both exhaust and return air.

Vacuum cleaners equipped with HEPA filters.

Enclosure or isolation of processes producing airborne asbestos fibers and dust.

Use of wet methods, wetting agents or removal encapsulants to control employee exposures during their performance of asbestos abatement activities. Where wet methods would result in equipment damage or a safety hazard, dry removal is allowed with written approval from WDNR pursuant to NR447.08(3)(b).

Prompt disposal of wastes contaminated with asbestos in leak-tight containers.

Supplement to Control Measures: Whenever the control measures described above are not sufficient to reduce the employee exposure to or below the "Permissible Exposure Limits" (TWA and/or Excursion Limit), the Contractor shall continue to use the control measures to maintain the employee exposure to the lowest levels attainable and supplement them with the use of appropriate respiratory protection and protective clothing.

Negative-Pressure Enclosure: A negative-pressure enclosure shall be employed whenever feasible, prior to commencing removal, demolition and renovation operations involving asbestos containing materials.

Respiratory Protection: The Contractor shall provide employees with appropriate respiratory protection in accordance with 29 CFR 1926.1101 Asbestos Construction Standard and 29 CFR 1910.134 Respiratory Protection.

NOTE: Respirators assigned for higher environmental concentrations may be used at lower concentrations.

A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

Employee Rotation: The Contractor shall not use employee rotation as a means of compliance with Permissible Exposure Limits (TWA and/or Excursion Limit).

Supervision: The Contractor shall have a project supervisor on site at all times that only supervises the project and is responsible to assure contract and regulatory compliance.

B. PREPARATION OF REGULATED AREA

Post the following warning signs at all approaches to a regulated area per OSHA 1926.110(k)(7). Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any person to read the sign and take the necessary protective measures before entering the area marked by the signs.

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORZIED PERSONNEL ONLY

Post the Occupant Protection Plan at the entrance to the regulated area per DHS 159.21(3).

Post at the entrance to the regulated area a list containing the names, addresses and telephone numbers of the Contractor, Fire Department and any other personnel who may be required to be contacted during abatement activities.

Maintain Project Log per DHS 159.21(2).

Shutdown and lock out all heating, cooling and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Appropriate equipment and control measures shall be utilized to prevent contamination of building spaces. Seal all intake and exhaust vents in the work area with tape and two layers of 6 mil polyethylene. Also seal any seams in system components that pass through the regulated area.

All electrical circuits to the area in which asbestos abatement work is to take place must be disconnected. The regulated area and other uncontaminated areas that were dependent on the disconnected electrical circuits shall be serviced by a temporary electrical service provided by owner. In accordance with the latest issue of the National Electrical Code, temporary electrical service shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with over-center switching mechanism so that contact cannot be held closed.

Preclean all movable objects within the regulated area using a HEPA filtered vacuum or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.

Preclean all fixed objects in the regulated area using HEPA filtered vacuums or wet cleaning techniques as appropriate, if contamination is visibly covering them. Careful attention must be paid to machinery and behind grills or gratings where access may be difficult but contamination significant. Also pay particular attention to wall, floor and ceiling penetrations behind fixed items. After precleaning, enclose fixed objects in four (4) mil polyethylene sheeting and seal securely in place with tape.

Preclean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming

with equipment not equipped with HEPA filters. Do not disturb asbestos containing materials during the precleaning phase.

Seal off all windows, doorways, elevator openings, corridors, tunnels, entrances, drains, ducts, grills, grates, diffusers, skylights and any other openings between the regulated area and uncontaminated areas outside of the regulated area (including the outside of the building, tunnels and crawl spaces) with four (4) mil polyethylene sheeting and tape.

Wall Covering:

Where surfacing materials are being removed from overhead, walls shall be covered with two (2) layers of four (4) mil polyethylene sheeting, starting at top of wall and extending down and across the floor area until it meets in the center of the floor. Here the covering sheets shall be taped together to form a monolithic covering which completely encases the regulated area.

Polyethylene sheets shall be sized to minimize seams. Seams shall be staggered and separated by a distance of at least six (6) feet.

Wall sheeting shall be secured adequately to prevent it from falling away from the walls. This may require additional support/attachment when negative pressure ventilation systems are utilized.

Floor Covering:

The floor area, which has previously been covered with sheeting extended from the walls, shall be covered with one additional layer of six (6) mil (minimum) sheeting. Provide additional protection such as plywood, canvas, or extra plastic sheeting for floors requiring special protection such as carpeting, hardwood flooring and tile floors which may be damaged by water leakage, ladder feet or scaffold wheels. Additional layers of sheeting may be utilized as drop cloths to aid in cleanup of bulk materials.

Polyethylene sheets shall be sized to minimize seams. If the floor area necessitates seams, those on successive layers of sheeting shall be staggered to reduce the potential for water to penetrate to the flooring material. A distance of at least six (6) feet between seams is sufficient. Do not locate any parallel seams at wall/floor joints.

Floor sheeting shall extend at least 24" up the side walls of the work area.

C. DECONTAMINATION ENCLOSURE SYSTEM

A decontamination enclosure system shall be provided at each location where workers will enter or exit a regulated area.

Plans for construction, including materials and layout, shall be submitted as shop drawings and approved by the Architect/Engineer prior to work initiation. Decontamination enclosure systems constructed at the work site shall utilize six (6) mil opaque black or white polyethylene sheeting or other acceptable materials for privacy. Detailed descriptions of portable, prefabricated units, if used, must be submitted for the Architect/Engineer's approval. Plans must include floor plan with dimensions, materials, size, thickness, plumbing and electrical utilities.

The decontamination enclosure system shall consist of at least a clean room, a shower room, and an equipment room, each separated from each other and from the regulated area by air locks.

Entry to and exit from all airlocks and decontamination enclosure system chambers shall be through curtained doorways consisting of two sheets of overlapping six (6) mil polyethylene sheeting. The

curtain doorway sheets shall be secured at the top and one side opposite each other. All curtains shall have weights attached to the bottom to insure that they hang straight and maintain a seal over the doorway when not in use. Doorway designs, providing equivalent protection and acceptable to the Architect/Engineer may be utilized.

Access between any two rooms in the decontamination enclosure system shall be through an airlock with at least three (3) feet separating each curtained doorway. Pathways into (from clean to contaminated) and out from (contaminated to clean) the regulated area shall be clearly designated.

The clean room shall be sized to adequately accommodate the work crew. Clean, disposable clothing, replacement filters for respirators, disposable towels and other necessary items shall be provided in adequate supply in the clean room. A location for postings shall also be provided in this area. Whenever possible, a lockable door shall be used to permit access into the clean room from outside the regulated area.

The shower room shall contain one or more shower heads as necessary to adequately accommodate workers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to insure against leakage of any kind. An adequate supply of soap and disposable towels shall be supplied by the Contractor and available at all times. Shower water shall be drained, collected and filtered as specified in the Article entitled: "Water Collection and Disposal," herein.

The equipment room shall be used for storage of equipment and tools at the end of a shift after workers have been decontaminated using a HEPA filtered vacuum and/or wet cleaning techniques as appropriate. Replacement filters (in sealed containers until used) for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers or surfactant and other materials and equipment that may be required during the abatement, may also be stored here as needed. A walk-off pan (a small children's swimming pool or equivalent filled with water) shall be located in the regulated area just outside the equipment room for workers to clean off foot coverings after leaving the regulated area and prevent excessive contamination of the worker decontamination enclosure system. A drum lined with a labeled six (6) mil polyethylene bag for collection of disposable clothing shall be located in this room. Contaminated rubber boots or other reusable footwear shall be stored in this area for reuse the following workday.

Waste Container Pass-Out Airlock:

The waste container pass-out airlock shall be constructed at some location away from the worker decontamination enclosure system. Wherever possible, this shall be located where there is direct access from the regulated area to the outside of the building.

This airlock system shall consist of an airlock, a container staging area, and another airlock with access to outside the regulated area.

The waste container pass-out airlock shall be constructed in similar fashion to the worker decontamination enclosure system using similar materials and airlock and curtain doorway designs.

This airlock system shall not be used to enter or exit the regulated area. The airlock system shall be tightly sealed when not in use.

Emergency exits shall be established and clearly marked with duct t ape arrows or other effective designations to permit easy location from anywhere within the regulated area. They shall be secured to prevent access from uncontaminated areas, but still permit emergency exiting. These exits shall be properly sealed with polyethylene sheeting which can be cut to permit egress if needed. These exits

may be through the decontamination enclosure, the waste pass-out airlock, or other alternative exits satisfactory to fire officials.

D. TEMPORARY ISOLATION PARTITIONS

Large rooms or open areas that require temporary air tight barriers to separate a contaminated regulated area from an uncontaminated area shall be provided with temporary partitions, constructed in the following manner:

Walls shall be constructed of wood or metal framing to support barriers in all openings larger than 4' x 8'.

A sheathing material (plywood, drywall) of at least 3/8" thickness shall be applied to work side of barrier.

Cover the work side of partition with a double layer of four (4) mil polyethylene sheeting with staggered joints and seal in place.

Provide at least one (12" x 12") window in the barrier system, where feasible, for the purpose of viewing into the regulated area. The window shall consist of heavy gauge plastic or clear safety glass. Panes shall be framed into the barrier system and completely sealed to prevent any leakage of air through the unit.

E. MAINTENANCE OF ENCLOSURE SYSTEM

Following completion of the construction of all polyethylene barriers and decontamination system enclosures, initiate negative pressure system and ensure that barriers will remain intact and secured to walls and fixtures before beginning actual abatement activities.

All polyethylene barriers and decontamination enclosure systems shall be inspected at least twice daily by the Contractor's competent person prior to the start of each day's abatement activities and following the completion of the day's abatement activities. Document inspections and observations in the daily project log.

Damage and defects in the enclosure system are to be repaired immediately upon discovery.

Use smoke tubes to test the effectiveness of the barrier system when directed by Owners Project Representative.

Anytime during the abatement activities, if visible construction related dust or debris is observed outside of the regulated area or if damage occurs to barriers, work shall immediately stop, repairs shall be made to barriers, and debris/residue cleaned up using appropriate HEPA vacuuming and wet mopping procedures.

Openings made in the enclosure system to accommodate negative air pressure system shall be made airtight with tape and caulking as needed. If more than one unit is installed, they should be turned on one at a time, checking the integrity of wall barriers for secure attachment and need for additional reinforcement. Insure that adequate power supply is available to satisfy the requirements of the ventilating and exhaust units. Negative pressure units shall be exhausted to the outside of the building. They shall not be exhausted into occupied areas of the building. Careful installation and daily inspections shall be done to insure that the ducting does not release fibers into uncontaminated building areas.

Use of enclosure system shall not commence until the following has been accomplished:

Enclosure systems have been constructed, inspected, and tested.

Negative pressure systems are functioning adequately.

All preabatement submissions, notifications, postings and permits have been provided and approved by the Architect/Engineer, or Construction Representative, as applicable.

All equipment for abatement, cleanup and disposal are on hand.

All worker training is completed.

Contractor has received written notice to commence abatement work from the Division, based on recommendation of the Owners Project Representative.

F. WORKPLACE ENTRY AND EXIT PROCEDURES

All workers and authorized personnel shall enter the regulated area through the decontamination enclosure system.

All personnel who enter the regulated area must sign the registration log, located in the clean room, both upon entry and exiting the area.

All personnel shall proceed first to the clean room, remove all street clothes, and appropriately don respiratory protection (as approved for the job conditions) and disposable coveralls, head covering and foot covering. Hard hats, eye protection and gloves shall also be utilized if required. Clean respirators and protective clothing shall be provided and utilized by each person for each separate entry into the regulated area.

Personnel wearing designated personal protective equipment shall proceed from the clean room through the decontamination enclosure system to the regulated area.

Before leaving the regulated area all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing or wet wiping procedures. (Small HEPA vacuums with brush attachments may be utilized for this purpose.) Each person shall clean bottoms of protective footwear in the walk-off pan just prior to entering the equipment room.

Personnel shall proceed to equipment room where they remove all protective equipment except respirators. Deposit disposable clothing into appropriately labeled containers for disposal.

Reusable, contaminated footwear shall be stored in the equipment room when not in use in the regulated area. Upon completion of abatement it shall be disposed of as asbestos contaminated waste. Rubber boots may be decontaminated at the completion of the abatement for reuse.

Still wearing respirators, personnel shall proceed to the shower area, clean the outside of the respirators and the exposed face area under running water prior to removal of respirator and shower and shampoo to remove residual asbestos contamination. Various types of respirators will require slight modification of these procedures. An airline respirator with HEPA filtered disconnect protection may be disconnected in the equipment room and worn into the shower. A powered air purifying respirator face piece will have to be disconnected from the filter/power pack assembly which is not waterproof, upon entering the shower. Cartridges must be in place for each new entry into the regulated area.

After showering and drying off, proceed to the clean room and don street clothing, even though there will be later reentry into the regulated area or street clothes, if it is the end of the work shift.

Workers shall NOT eat, drink, smoke, chew gum or tobacco in the regulated area. To eat, drink or smoke, workers shall follow the procedure described above, then dress in street clothes before entering the nonregulated areas of the building.

These procedures shall be posted in the clean room and equipment room.

G. WASTE CONTAINER PASS-OUT PROCEDURE

Asbestos contaminated waste that has been containerized shall be transported out of the regulated area through the waste container pass-out airlock (or through the decontamination enclosure if a separate airlock has not been constructed).

The inside team wearing protective clothing and respirators appropriate for the contaminated regulated area shall clean the entire surface, including bottoms, of properly labeled bags, using HEPA vacuums and wet wiping techniques and transport them into the waste container pass-out airlock where they will be placed into another properly labeled bag. No worker from the inside team shall further exit the regulated area through this airlock.

Workers from outside the regulated area wearing appropriately assigned respirators, shall enter the airlock from outside the regulated area. No worker from the outside team shall further enter the regulated area through this airlock.

The exit from this airlock shall be secured to prevent unauthorized entry.

H. WATER COLLECTION AND DISPOSAL

All water resulting from precleaning operation, excess from floor of regulated area and the final cleaning operation shall be collected and placed in sealed containers for disposal as contaminated material.

Water from the decontamination shower shall be collected in a holding tank and filtered to remove particles of 0.5 microns or larger size before draining water into sanitary sewer system. The drainage and filtering system shall consist of the following:

A centrifugal pump capable of pumping at least 25 gallons/minute.

Two filter cartridge housings, one serving as a prefilter, utilizing at least 6 cylindrical 100 micron filters (reusable type) and the other serving as final filter with 6 cylindrical 0.5 micron filters.

Maintain two sets (6 cylinders per set) of 100 micron filters, to allow one set to be cleaned while the other set is in use.

A common garden hose may be connected to final filter housing to drain water to sanitary sewer system.

I. WET REMOVAL PROCEDURE

Wet all asbestos containing material with an amended water solution, or removal encapsulant, using equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Saturate the material to the substrate. Keep all removed material wet to prevent fiber release until it can be containerized for disposal. If regulated area temperatures are

below 32^{O}F and amended water is subject to freezing, modify as specified for surfactant in Article entitled: "Materials," herein. Maintain a high humidity in the regulated area by misting or spraying to assist in fiber settling and reduce airborne concentrations.

Saturated asbestos containing material shall be removed in manageable sections. Removed material should be containerized before moving to a new location for continuance of work. Surrounding areas shall be periodically sprayed and maintained in a wet condition until visible material is cleaned up.

Material removed from building structures or components shall not be dropped or thrown to the floor. Material should be removed as intact sections or components whenever possible and carefully lowered to the floor. If this cannot be done for materials greater than 50 feet above the floor, a dust-tight chute shall be constructed to transport the material to containers on the floor or the material may be containerized at elevated levels (e.g. on scaffolds) and carefully lowered to the ground by mechanical means. For materials between 15 and 50 feet above the ground they may be containerized at elevated levels or dropped onto inclined chutes or scaffolding for subsequent collection and containerization.

Bags shall be considered full when half their capacity have been filled. They should be securely sealed to prevent accidental opening and leakage by tying tops of bags in an overhand knot or by taping in gooseneck fashion. Do not seal bags with wire or cord.

Large components removed intact may be wrapped in two (2) layers of six (6) mil polyethylene sheeting secured with tape for transport to the approved disposal site.

Asbestos containing waste with sharp edged components (e.g., nails, screws, metal lath, tin sheeting) shall be placed into drums for disposal in lieu of polyethylene bags. Drums shall be marked to differentiate contents from those drums containing bagged material.

After completion of all stripping work, surfaces from which asbestos containing materials have been removed, such as plaster base coat or metal deck, etc., shall be wet brushed and sponged to remove all visible residue.

J. CEILING SYSTEM REMOVAL

Remove, clean and enclose in polyethylene the ceiling mounted objects such as lights and other items that may interfere with the abatement process and were not previously cleaned and sealed off. Utilize localized spraying of amended water, or HEPA vacuums, to reduce fiber dispersal during the removal of these fixtures.

Remove ceiling (tiles) (panels) within the regulated area carefully. If panels are to be reused, vacuum them with a HEPA filtered vacuum cleaner and carefully damp sponge and wrap cleaned (tiles) (panels) in four (4) mil polyethylene sheeting and seal with tape. Store as designated by Owner's Project Representative (preferably outside of the regulated area). If (tiles) (panels) are to be discarded it is not necessary to clean them, but wrap in a similar fashion and stage for disposal in the waste container pass-out airlock.

Where suspended ceiling T-grid components must be removed to perform the abatement, HEPA vacuum and wet sponge each piece after removal from hangers. Wrap clean grid pieces in four (4) mil polyethylene sheeting and seal with tape. Store as designated by Owner's Project Representative or in waste staging area if designated for disposal.

When removal of ceiling grid suspension system is not necessary for accessibility to the asbestos containing materials, leave the system in place and clean properly following completion of abatement, as specified in the Article of this section entitled: "Cleanup Procedure."

Remove plaster/drywall ceilings including lath, furring channel system, wire mesh, ties, clips, screws, nails and other accessory items as necessary and dispose of them as asbestos contaminated waste material. As work progresses, spray ceiling materials and debris with amended water to keep wet until containerized for disposal.

K. PIPE TUNNEL OR CRAWL SPACE REMOVAL WORK

A decontamination enclosure shall be provided at the entrance to the pipe tunnel or crawl space. All requirements for regulated area entry and exit procedures and waste container pass-out procedures, as hereinbefore specified, shall apply to this work.

All openings within the pipe tunnel or crawl space shall be sealed with four (4) mil polyethylene and tape. The existing surfaces within the space will not be required to be covered with polyethylene sheeting.

A negative pressure system shall be required to maintain the security of the work space and the integrated decontamination enclosure.

All loose and fallen asbestos-containing material shall be very carefully cleaned up with an industrial vacuum equipped with HEPA filter.

After asbestos abatement work has been completed in the crawl space or pipe tunnel, all ceiling, wall and floor surfaces shall be cleaned with the HEPA equipped vacuum. All cleaned surfaces shall be sealed with an approved encapsulant.

L. FLOORING REMOVAL

Where flooring removal is specified with the use of solvents to remove flooring adhesive, the substrate shall have no adhesive residue or debris remaining. Contractor shall wash the substrate with soap and water to remove all solvent. Contractor shall be responsible for the cost of repair or replacement of any building components damaged by excessive use of solvents.

Where flooring removal is specified without the use of solvents to remove flooring adhesive, the contractor shall diligently remove adhesive by scraping process so that all trowel marks are removed and a uniform substrate, smooth to the touch, is attained. Contractor shall coordinate with the flooring installer to insure that the remaining substrate is suitable for replacement flooring installation.

M. SMALL SCALE - SHORT DURATION REMOVAL PROCEDURE

Glovebag Method:

All workers who are permitted to use the glovebag technique must be trained, experienced and skilled in this method.

All tools and materials that will be required during the removal procedure shall be placed into the tool pouch.

Glovebag shall be installed so that it completely encompasses the surface where removal work will take place. The side seams of the glovebag shall be cut the appropriate length to accommodate a size that will fit over the removal area. The bag shall be placed in position, the edges of the bag shall be folded together and sealed with tape. All openings in the bag shall be sealed with duct tape (or equivalent material). The bottom seam of the bag must also be sealed with tape to prevent leakage.

Workers performing asbestos removal with glovebag shall wear (at a minimum) half mask dual-cartridge HEPA-equipped respirator, and full protective clothing to protect against the possibility of accidental leakage.

All material removed within the glovebag shall be thoroughly wetted with wetting agent, or removal encapsulant, applied with airless sprayer through the side port provided in the bag. After asbestos containing material has been removed, the exposed base surface must be thoroughly cleaned and wet wiped until all traces of asbestos-containing material is removed.

Create constant negative pressure by running a HEPA vacuum hose into bag.

Any exposed edges of asbestos-containing that will remain after bag is removed shall be encapsulated with a bridging encapsulant to seal the material from releasing fibers to the atmosphere. Provide neatly beveled and coated terminations, where insulation terminates, suitable for a butt joint with new insulation.

In all glovebag removal settings, all doors, windows and other openings to the functional space must be sealed with a minimum of four (4) mil polyethylene sheeting. The HVAC system must be shut down. Once the area is completely sealed off, negative air pressure must be introduced to the entire functional space.

In glovebag settings which involve small scale short duration removal the immediate area shall be prepared using the following techniques: polyethylene drop cloths (minimum 6 mil) on floor and walls in a 12 foot perimeter of the removal area with a negative air machine present and running in the immediate area. Glovebag must be placed under variable negative pressure during removal stages. A centralized three stage decontamination system must be established in the building for this method of glovebag removal.

Mini-Enclosure Method:

A mini-enclosure may be built around an area which is too large for glovebag method, but is of small-scale and short duration work and would not warrant large enclosure.

The mini-enclosure can be small enough to restrict the space to use by one worker. A small change room shall be contiguous to the mini-enclosure. The change room shall be a minimum of 3′ x 3′

The mini-enclosure shall be constructed by affixing plastic sheeting to existing walls and covering the floor with plastic sheeting, which shall extend up walls at least 24 inches and sealed with tape. If existing walls are not available, frame shall be constructed and two (2) layers of six (6) mil polyethylene sheeting applied to the interior side of frame to allow clean "take-down" at completion. Sheeting shall be sealed with tape.

The change room shall be constructed of framing to which shall be applied two (2) layers of six (6) mil polyethylene sheeting to interior side of frame and sealed with tape. The change room shall be provided with double six (6) mil polyethylene curtains at the exit and the entrance to the mini work enclosure. Both curtains in each opening shall be secured at the top and one side opposite from the other.

A hose from a HEPA vacuum shall be extended through the wall of the mini-enclosure and the opening around the hose shall be sealed with tape. The HEPA vacuum shall run continuously during the time asbestos abatement work is taking place.

All abatement work shall be conducted using the wet removal method and all debris from such work shall be bagged and disposed of as contaminated material. Upon completion, the interior surfaces of the regulated area shall be cleaned and sprayed with an encapsulant.

Worker using the mini-enclosure method shall wear two (2) Tyvek^{R} or equivalent disposable work suits and the appropriate HEPA filtered dual cartridge respiratory protection. Upon completion of the work and before leaving the change area, worker shall remove outer work suit and then proceed to a shower that is not contiguous with the work area.

The polyethylene enclosure, comprising the regulated area and the change room, shall be collapsed inwardly, bagged and disposed of as contaminated material.

N. ENCAPSULATION PROCEDURES

Clean and isolate the regulated area as specified in Article entitled: "Preparation of Regulated Area", hereinbefore.

Repair damaged and missing areas of existing materials with nonasbestos-containing substitutes. Material must adhere adequately to existing surfaces and provide an adequate base for application of encapsulating agents. Filler material shall be applied in accordance with manufacturer's recommended specifications.

Spray apply using airless equipment with low nozzle pressure to all surfaces where asbestos is removed or surfaces containing asbestos that are to remain in place. Spray must completely encapsulate any remaining asbestos, permanently locking it in place.

Apply a minimum of one (1) coat with coverage in strict accordance with manufacturer's recommendations. Surfaces must be dry and free of dirt, oil and dust.

O. ENCLOSURE PROCEDURE

Clean and isolate the regulated area as specified in Article entitled: "Preparation of Regulated Area" hereinbefore.

Spray areas that will be disturbed during the installation of hangers or other support/framing materials for the enclosure with water containing the specified surfactant. Keep these areas damp to reduce airborne fiber concentrations.

Remove loose or hanging asbestos containing materials.

After installation of hangers and other fixing devices and before installation of enclosure, repair damaged areas of fireproofing/thermal insulation materials as required using a nonasbestos-containing replacement material. Prepare surfaces and apply replacement material in accordance with manufacturer's recommendations.

P. AIR MONITORING

Daily Personal Air Monitoring (OSHA Compliance):

> Daily determination of employee exposure shall be made by collecting one or more breathing zone samples that are representative of the 8-hour TWA, full-shift exposure for each employee in each regulated area; and one or more breathing zone air samples that are representative of 30-minute exposures associated with operations that are most likely to produce exposures above the excursion limit for employees in each regulated area.

OSHA P.E.L. As required by 29CFR 1926.1101(c). Within the breathing zone of each worker category (i.e., wetter, receiver, bagger) 25% of the crew or one per job category.

All samples collected shall be analyzed by a laboratory accredited by the American Industrial Hygiene Association or in accordance with 1926.1101 – Appendix A.

The Owners Project Representative has the authority to stop the abatement work under the provisions of the General Conditions of this contract at anytime the Representative determines either personally or through the services of an air sampling professional that conditions are not in compliance with the specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Construction Representative. Standby time required to resolve violations shall be at the Contractor's expense.

Q. CLEANUP PROCEDURE

Remove and containerize all visible accumulations of asbestos containing material and asbestos contaminated debris utilizing rubber dust pans and rubber squeegees to move material around. Do not use metal shovels to pick up or move accumulated waste. Special care shall be taken to minimize damage to floor sheeting.

Wet clean all surfaces in the regulated area using rags, mops and sponges as appropriate. (Note: Some HEPA vacuums might not be wet-dry vacuums.)

Prior to removing the inner layer of plastic sheeting, the sheeting shall be sprayed with an encapsulant, so that any residue remaining will be adhered to the plastic sheeting.

Remove the cleaned inner layer of plastic sheeting from walls and floors. Windows, doors, HVAC system vents and all other openings shall remain sealed. The negative pressure ventilation units shall remain in continuous operation. Decontamination enclosure systems shall remain in place and be utilized.

Remove all containerized waste from the regulated area and waste container pass-out airlock.

The DFD's Project Representative, DNR Representative and the Contractor shall inspect the regulated area for visible residue. If any accumulation of residue is observed, it will be assumed to be asbestos and the cleaning cycle shall be repeated.

After cleaning the regulated area the Contractor may either spray the remaining barrier material with encapsulant, or wait at least 24 hours to allow fibers to settle and HEPA vacuum and wet clean all objects and surfaces in the regulated area again.

Decontaminate all tools and equipment and remove at the appropriate time in the cleaning sequence.

R. DISPOSAL PROCEDURES

As the work progresses to prevent exceeding available storage capacity onsite, sealed and labelled containers of asbestos-containing waste shall be removed and transported directly to the prearranged disposal location, which must be an authorized site in accordance with regulatory requirements of NESHAP and Wisconsin Administrative Rule NR 447.13, 502.06 and NR 506.10. Use of intermediate storage locations is not an accepted disposal procedure. Mark vehicles used to transport asbestos-containing waste in accordance with NR 447.12(4)(a)1 to 3. Comply with US DOT Hazardous Material regulations, 49 CFR 171-180.

The Contractor shall provide documentation in the form of a transportation and disposal manifest that will provide a chain-of-custody record of all asbestos-containing waste from project site to the disposal site. All asbestos-containing waste generated must be accounted for by these records and copies of all such records shall be delivered to the Construction Representative.

Transportation to the Landfill:

Contractor shall provide an enclosed lockable waste container, consisting of a truck, trailer or dumpster, for storage and transportation of waste. The waste container shall be locked while unattended and during transportation of waste. Once bags have been removed from the regulated area, they shall be loaded directly into the waste container for transportation.

The waste container shall be free of debris and lined with six (6) mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first and extend up the side walls. Wall sheeting shall be overlapped and taped into place.

Drums shall be placed on level surfaces in the waste container and packed tightly together to prevent shifting and tipping. Large components shall be secured to prevent shifting and bags placed on top. Do not throw containers into waste container.

Personnel loading asbestos containing waste shall be protected by disposable clothing including head, body and foot protection and at a minimum, half-face piece, air-purifying, dual cartridge respirators equipped with HEPA filters.

Any debris or residue observed on containers or surfaces outside of the regulated area resulting from cleanup or disposal activities shall be immediately cleaned up using HEPA filtered vacuum equipment and/or wet methods.

Disposal at the Landfill:

Upon reaching the landfill, trucks are to approach the dump location as closely as possible for unloading of the asbestos containing waste.

Bags, drums and components shall be inspected as they are off-loaded at the disposal site. Damaged containers shall be very carefully taped shut and repacked into drums or bags as applicable.

Waste containers shall be placed on the ground at the disposal site, not pushed or thrown out of trucks (weight of wet material could rupture bags).

Personnel off-loading containers at the disposal site shall wear protective equipment consisting of disposable head, body and foot protection and, at a minimum, half-face piece, air-purifying, dual cartridge respirators equipped with HEPA filters.

Following the removal of all containerized waste, the truck cargo area shall be decontaminated using HEPA vacuums and wet methods to meet the no visible residue criteria. Polyethylene sheeting shall be removed and discarded along with contaminated cleaning materials and protective clothing in bags or drums at the disposal site.

S. REESTABLISHMENT OF REGULATED AREA

Reestablishment of the regulated area shall occur only after completion of cleanup procedures and documentation has been performed to the satisfaction of the Owner's Representative.

Resecure mounted objects removed from their former positions during area preparation activities.

Resecure and relocate objects that were removed to temporary locations back to their original positions.

Reestablish HVAC, mechanical and electrical systems in proper working order. Remove potentially contaminated HVAC system filters and dispose of as asbestos contaminated waste. Decontaminate filter assembly using HEPA vacuums and wet cleaning techniques.

END OF SECTION

Asbestos/Lead Abatement Certification

The apparent low bidder on any project involving asbestos and/or lead abatement activity must provide the following statement notarized and signed by an officer of the firm, before the end of the seventh calendar day after the bid opening.

Note: For certified statements 1-3 below: If no exceptions exist, state "None"; otherwise include project(s), date(s), description and resolution for each (attach additional sheets if necessary).

This is to certify that _____
Firm Name

1) has not been issued any citations by federal, state or local regulatory agencies relating to asbestos or lead abatement activity, except as follows:

_____

2) has not had an asbestos or lead abatement contract terminated prior to completion, except as follows:

_____

3) has not been named in any asbestos or lead related legal proceedings/claims in which the firm (or employees scheduled to participate in this project) was involved as contractor or subcontractor, except as follows:

_____

4) has all employees or agents who may be exposed to airborne asbestos in excess of the OSHA PEL medically determined to be physically capable of working while wearing the respirator

5) will utilize only HEPA vacuums, negative pressure ventilation units and other local exhaust ventilation equipment conforming to ANSI Z9.2-79 and that water filtration unit(s) are used in conformance with manufacturer's specifications

6) has notified rental agencies that rental equipment will be used in abatement areas or to transport asbestos contaminated waste, if contractor intends to use rented equipment

7) will utilize only NIOSH approved respiratory protective devices and that respirator fit-testing for all contractor employees and agents, who must enter the regulated area, are performed in accordance with procedures as detailed in Title 29 CFR 1926.1101, Appendix C, Qualitative and Quantitative Fit Testing Procedures

8) maintains a written hazard communication program indicating how the contractor plans to meet the requirements of OSHA 29 CFR 1926.59 relative to labeling, handling of material safety data sheets and training of employees.

The undersigned states that all of the above information is true and correct to the best of his/her knowledge.

_____ _____
Authorized Signature

_____
Printed Name

_____
Title

State of

_____ _____
Firm Name

Signed or attested _____ _____ , _____

By: _____ _____
Notary Public

(STAMP OR SEAL) My Commission Expires _____, 20____.

SECTION 03010
CONCRETE REPAIR AND MAINTENENCE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. This section includes the provision and installation of all materials, equipment and incidentals necessary and/or required for a complete installation of cement-based, polymer-modified, self-leveling underlayment for interior finish flooring as specified herein.

1.03 RELATED SECTIONS

A. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

1 Division 3 - Ground Concrete Finishing, Cast-In-Place Concrete Installation and curing requirements according to ACI 302, Pre-Cast Concrete Repair, Concrete paving of sidewalks, curbs and gutters.

2 Division 7 – Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.

1.04 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society of Testing and Materials (ASTM) and Others:

ASTM E1155	Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
ASTM C1077	Standard Practice for Laboratories Testing
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or testing.
ASTM C293	Standard Test Method for Flexural Strength of Concrete.
ASTM D2794	Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation.
ASTM C672/C672M-12	Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
ASTM C666/C666M-03	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
ASTM C642	Standard Test Method for Density, Absorption and Voids in Hardened Concrete.
ASTM C567	Standard Test Method for Determining Density of Structural Lightweight Concrete.
ASTM C42/C42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM 7234	Standard Test Method to Measure the Adhesion Strength between Coating and a Substrate.

ASTM C1583-04	Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Material by Direct Tension (Pull-off Method).
ACI 563-18	Specifications for Repair of Concrete in Buildings.
ACI 301	Specifications for Structural Concrete for Buildings.
ACI 117	Specifications for Tolerances for Concrete Construction and Materials.
ACI 347	Guide to Formwork for Concrete.
ACI 302.1R	Guide for Concrete Floor and Slab Construction.
ACI 503-30	Pull-off Adhesion Tester for Pull-Off Strength or Bond Testing.

1.05 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Submit manufacturer's product literature and installation instructions, use limitations and recommendations.

C. Submit product design drawings for review and approval to the Architect/Specifier prior to fabrication.

D. Material Certificates: For each material specified, signed by the manufacturer, certifying that materials meet or exceed specified requirements.

E. Design Mixtures: For each Concrete Repair Material. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

F. Material Test Reports: For each material specified, from a qualified testing agency, indicating compliance with requirements.

G. Field Quality-Control Reports.

H. Samples: Manufacturer to provide, upon request, sized to represent material adequately.

I. Technical Support: Contact the engineering group of Manufacturer as stated in 2.01A.

J. Warranty: Submit a sample of Manufacturer's warranty identifying the terms and conditions stated in 1.09.

K. Substitutions: To be accepted as an equal a product, substitution must have demonstrated documented field trials, independent testing and must comply with all performance criteria. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification in addition to submitting alternative manufacturers independent testing and product information.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm with not less than **[10]** years' experience in manufacturing Concrete Repair Materials of the type specified, capable of providing test reports indicating compliance with specified performance requirements.

B. Installer Qualifications: A firm having at least 3 years' experience in installing Concrete Repair Materials.

C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single Manufacturer.

D. Pre-Application Conference (as needed): A pre-application conference with Contractor, Manufacturer or Authorized Representative, shall be held to establish procedures and to review conditions, installation procedures and coordination with other related work. Meeting agenda shall include review of the special details.

E. Factory Trained Concrete Repair Contractor: The concrete repair contractor must be factory trained by the Concrete Repair Material Manufacturer, prior to bid.

F. Testing Agency Qualifications: An independent agency, acceptable to Authorities Having Jurisdiction (AHJ), qualified according to ASTM C1077 and ASTM E329 for testing indicated.

G. Bond Testing: Bond tests results shall be evaluated by the Concrete Repair Material Manufacturer as part of the Warranty process.

H. Source Limitations: Each type of Concrete Repair Material shall be procured from the same Manufacturer.

I. Manufacturer's Representative: Arrange to have trained representative of the Manufacturer available (in-person or electronically) to review installation procedures.

J. Review special inspection, testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction contraction and isolation joints, joint-filler strips, concrete repair procedures and concrete protection.

1.07 DELIVERY, STORAGE, HANDLING

A. Concrete Repair Material should be a high early strength, non-shrinking mortar, using no water and containing no Portland cement. Materials should be delivered to site in Manufacturer's original, unopened containers with original labels attached and bearing the following information:

1 Name of material.

2 Manufacturer's batch code including date of manufacture.

3 Materials Safety Data Sheets

B. Concrete Repair Material shall be unloaded and stored carefully. Cartons and containers must be protected from weather, sparks, flames, excessive heat, cold and lack of ventilation. Do not double stack cartons. Cartons should be stored on pallets and covered to protect from water damage. Any damaged material must be removed from the site and disposed of in accordance with applicable regulations.

C. Setting time of the mixed material will be greatly accelerated if the components are stored in a warm or hot environment; conversely, the setting time is extended if the materials are kept cool.

D. Flush all spills with water.

E. Keep container closed when not in use. Follow MSDS and label warning even after package is empty. Do not cut, puncture, or weld on empty container. Product applications, which generate dust, mist, or fumes may require exposure limit modification.

F. Comply with Manufacturer's written instructions for handling prior to installing.

G. Comply with Manufacturer's written instructions for storage.

1.08 PROJECT CONDITIONS

A. Work should be performed only when existing and forecasted weather conditions are within the limits established by the Manufacturer.

B. Verify that other trades with related work are completed prior to applying Concrete Repair Material.

C. Observe all appropriate OSHA safety guidelines for this work.

D. Waste Disposal: Dispose of waste in accordance with all federal, state and local regulations.

E. Maintain work area in a neat and workmanlike condition. Remove empty cartons and rubbish from the site daily.

1.09 WARRANTY

A. Manufacturer's Warranty: Standard form warranty document, warrants all goods sold to be free from defects in manufacturing, but limits liability to **[1]** year(s) from date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design Product: The Concrete Repair Material is based on **1260 MG-KRETE™** manufactured by **Imco® Technologies Inc.** 6254 Skyway Road, PO Box 915, Smithville ON, LOR 2A0, Canada; Telephone: 888-818-4626; fax: 905-527-0606; Email: info@imcotechnologies.com: Web Site: www.imcotechnologies.com.

B. Substitutions will be considered, subject to compliance with requirements of this section, under provisions of Section 01600.

2.02 PRODUCTS

A. Once installed, Concrete Repair Material must meet the properties listed below:

PHYSICAL PROPERTIES:	
PROPERTY	**ENGLISH**
Flash Point	none

Compressive Strength:	
45 minutes	2,610 psi/18.0 MPa
24 hours	5,148 psi/35.5 MPa
7 days	5,815 psi/40.1 MPa
28 days	11,194 psi/77.2 MPa
Set time:	
Initial @ 20°C (68°F)	15 minutes
Application temp:	minimum -10°C (14°F)(with Low Temp. Accelerator)
	over 40°C (100°F)(with High Temp. Retarder)
Primer	No primer required
Clean-up	Water (before material sets)
Shelf Life	6 months, if stored away from direct heat
No. of Components	Two (Part A and B)
Available Grade	fine or regular grade
Packaging:	
Regular grade	22.7 kg (50lb) Part A with 3.78L (1 gal) Part B
Fine grade	20.0 kg (45lb) Part a with 3.78L (1 gal) Part B
Available in bulk packaging	
Yield:	
Regular grade	1 unit = 0.45 cu. ft. of mixed material 78 units = 1 cu. Meter
Fine grade	1 unit = 0.40 cu. ft. of mixed material

2.03 MATERIAL CHARACTERISTICS

A. The concrete repair, re-sloping, overlay and deep fill material must have the following characteristics:

1 Two component system with no water allowed
2 Contain no Portland cement
3 Ability to retard set times
4 Ability to accelerate set times
5 Must be able to install horizontal, overhead and vertical applications with the same product
6 Non-critical mix ratio
7 Deep fill to feather edge with same product

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify that installation meets the requirements of the Authority Having Jurisdiction (AHJ).

B. Verify that the Concrete Repair Material installation will not disrupt other trades.

C. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct any defects prior to any installation.

D. For applications at ambient temperatures below 50°F (10°C), a low temp accelerator must be used to ensure a full cure.

E. For applications at ambient temperatures above 68°F (20°), a high temp retarder must be used to ensure a full cure.

F. Do not pre-wet surface.

G. Verify by comparing packing slip and box label that product is per specification.

H. Before placing Concrete Repair Material verify that installation of formwork is complete and that required inspections have been performed.

3.02 SURFACE PREPARATION

A. Refer to Manufacturer's specifications for surface preparation requirements. Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges. Prior to installation, remove dust, dirt, debris or any other foreign materials.

3.03 INSTALLATION

A. Follow Manufacturers guidelines for proper installation of Concrete Repair Material.

B. Mixing:

1 Keep all materials dry. **Do not add water to the mix.**

2 Maintain the mix ratio as supplied, i.e. one container of liquid activator to one bag of dry component.

3 Proper mixing will give a trowellable consistency suitable for most floor applications.

a. Slump may be adjusted to the applicators preference or to suit the specific job conditions by increasing either of the two components.

b. **DO NOT ADJUST THE SLUMP BY THE ADDITION OF WATER.**

4 Mix the two components by mechanical means until all the material is wetted and place quickly.

5 Dry pea gravel may be added to the mix to increase the yield on deep placements.

C. Placement:

1 **DO NOT ADD WATER** to concrete repair material at any time. Refer to Manufacturer's requirements.

2 Consolidate concrete repair material per Manufacturers requirements.

3 Deposit and consolidate concrete repair material for slabs in continuous operation, within limits of construction joints, until placement of a panel or section is complete.

a. Consolidate concrete repair material during placement operations per the Manufacturers requirements.

b. Finish Concrete Repair Material appropriate to application.

c. Slope surfaces uniformly to drains where required.

D. Cold-Weather Placement:
   1 Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2 Comply with ACI 306.1, Concrete Repair Material Manufacturers requirements, and as follows:
      a. When substrate and air temperature are below 50°F, provide a low temp accelerator, per Manufacturers requirement.
      b. Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture design.

E. Hot-Weather Placement:
   1 Comply with ACI 301, Concrete Repair Materials Manufacturers requirements, as follows:
      a. When substrate and air temperature are warm, provide a high temp retarder, per Manufacturers requirement.

3.04 FINISHING

A. Concrete Repair Material can be finished with screed, trowel or broom.

B. **OVER COATING** – Allow Concrete Repair Material to cure, per manufacturer's specification, prior to over coating.

C. Clean all tools with water immediately after each use.

D. Do not attempt to place Concrete Repair Material in water or where running water will disturb the worksite.

3.05 CURING

A. Concrete Repair Material must cure effectively in temperatures of 10°C/50°F or above.

B. Once the Concrete Repair Material is mixed, an immediate cure must be initiated.

C. When Concrete Repair Material is placed ½ inch thick at 20°C/68°F, it must set up in approximately 15 minutes (dependent upon other environmental conditions – for example sunlight or wind).

D. Concrete Repair Material must cure faster on thicker applications than it will on thin applications.
   1. The larger the mass, the more heat generated by the product and the quicker the cure.

3.06 FIELD QUALITY CONTROL

A. Testing: Retain a qualified testing agency to perform tests and to submit reports.

B. Test results shall be reported in writing to Architect, Concrete Repair Material Manufacturer and Contractor within 48 hours of testing.

C. Reports of compressive-strength tests shall contain:
   1 Project identification name and number.
   2 Date of placement.
   3 Name of testing and inspecting agency.

4 Location of Concrete Repair Material in Work.
5 Design compressive strength at 28 days.
6 Concrete Repair Material mixture proportions and materials.
7 Compressive breaking strength.
8 Type of break for 3-day, 7-day, and 28-day tests.

3.07 CLEANING AND PROTECTION

A. Concrete Repair Material must be cleaned up with water, before it cures.

B. Dispose of damaged material in accordance with all governmental regulations.

C. Protect completed work from subsequent construction activities as recommended by Manufacturer.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 RELATED SECTIONS

A. Section 03200 – Concrete Reinforcement.

B. Section 03300 – Cast-In-Place Concrete.

1.03 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Build in anchors, inserts, bolts, hangers, sleeves, ferrules, water stops and other accessories.

1.04 QUALITY ASSURANCE

A. Design, construct and erect formwork per ACI 347 Recommended Practice for Concrete Formwork. Refer to Section 6.1 of ACI 318 Code and Commentary.

1.05 ALLOWABLE TOLERANCES

A. In accordance with ACI 301 as listed in Table 4.3.1 – Tolerances for Formed Surfaces.

1.06 REFERENCES

A. ACI 301-16 – Specifications for Structural Concrete for Building

B. ACI 318-14 – Building Code Requirements for Structural Concrete

C. ACI 347R-14 – Recommended Practice for Concrete Formwork

D. ACI 347.2R-05 – Guide for Shoring/Re-shoring of Concrete Multistory Buildings

1.07 DESIGN OF FORMWORK AND SHORING

A. Design of formwork, shoring, and re-shoring and its removal is the Contractor's responsibility. Design formwork in a manner such that existing or new construction is not overstressed. Do not remove shoring earlier than recommended by ACI 301 and ACI 347.

B. Before starting construction, the Contractor shall develop a procedure and schedule for removal of shores and installation of re-shores for calculating the loads transferred to the structure. The structural analysis and concrete strength assumptions used shall be submitted to Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concealed Concrete: No. 2 Common Southern Pine, S4S, or better.

B. Exposed Concrete: B-B Plyform, Class I or II, EXT-APA, Metal or fiberglass forms may be used.

C. Construction joint forms for slabs-on-grade: Key-type steel formers, Vulcan Screed Joints, Burke Keyed Kold Joint Form, Dayton Sure-Grip G-20, or equivalent.

D. Expansion joint filler: Asphalt impregnated, pre-molded fiberboard by full thickness of slab or joint. ASTMD994.

E. Form coating: Non-staining mineral oil.

2.02 EARTH FORMS

A. Where soil is firm enough to permit cutting to true size, concrete may be placed without forms.

PART 3- EXECUTION

3.01 ERECTING

A. Erect forms to obtain shapes, designs and dimensions indicated. Make forms sufficiently tight to prevent leakage. Brace, shore and tie forms together to maintain position without sagging or bulging.

B. Provide ¾" chamfering at exposed corners.

C. Prepare insides of forms so that concrete will have a smooth, uniform finish, free from fins, stone pockets, voids and other surface defects.

D. Provide construction joint forms where concrete placement terminates at the end of a day or because of other reasons.

E. Provide bulkheads, with reinforcing steel penetrating bulkheads, where concrete placement stops at end of day or for other reasons.

F. Where soil conditions are such that concrete cannot be placed without forms, and where other conditions cause trenches to be opened wider than footing or slab widths, erect forms for footing or slabs.

G. Install items furnished by others for installation in concrete. Use templates to locate anchor bolts and other critical items.

H. In areas where concrete is sloped, have Surveyor verify drainage prior to placing concrete.

3.02 PREPARING

A. Prepare insides of forms so that concrete will have a smooth, uniform finish free of surface defects.

B. Coat forms before reinforcement steel is placed. Where mill-oiled forming material is used, follow manufacturer's instructions for recoating. Where forming material is not mill-oiled, coat forms before each use.

C. Before reusing forms, thoroughly clean them and remove projecting nails or similar devices.

D. Use of any forming lubricants shall not prevent application of spray on textured ceiling finishes.

3.03 CONSTRUCTION JOINTS

A. Provide construction in accordance with ACI 302, Chapter 6 and ACI 318.

B. Obtain the Architect's approval of construction joint locations.

3.04 FORM REMOVAL

A. Remove forms in such manner and such time as to insure safety of structure and to avoid chipping and spalling of concrete. Refer to Section 6.2 of ACI 318, Code and Commentary, and Section 376.2.3 of ACI 347 for form removal requirements.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 RELATED SECTIONS

A. Section 03100 – Concrete Formwork.

B. Section 03300 – Cast-In-Place Concrete.

C. Section 04200 – Unit Masonry

1.03 QUALITY ASSURANCE

A. Comply with American Concrete Institute (ACI) "Specifications for Structural Concrete for Buildings (ACI 301)" except as modified herein.

1. This standard is referred to as "ACI 301."
2. Maintain field references in accordance with Section 1.6 of ACI 301.

1.04 SUBMITTALS

A. Submit warranty from mill or supplier stating that materials meet requirements of referenced ASTM and ACI Standards.

B. Detail reinforcing steel in accordance with ACI 315, "Details and Detailing of Concrete Reinforcement." Submit prints of shop drawings per Section 01300 indicating bending and placement of reinforcement as well as sleeve and built-in work locations. Fabricator is responsible for making and distributing prints showing required revisions. Do not fabricate reinforcement steel until approval of Engineer has been obtained (or submit under provisions of Section 01300).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcement Steel: ASTM A615, Grade 60, deformed.

B. Welded Wire Fabric: Welded steel wire fabric, ASTM A185; wire size and spacing as indicated.

C. Bar Supports:

1. All surfaces exposed to weather or liquid or which can be seen in service condition shall have bar supports conforming to Class C, D, or E as defined in Chapter 9 of CRSI, Placing Reinforcing Bars. Where no protection is required, Class A supports may be used.

D. Other Supports:

1. Solid Concrete brick may be used to support reinforcement to obtain proper clearance from earth and rigidity of reinforcement under concreting operations. Concrete masonry brick shall not be used in lieu of solid concrete brick.

2.02 FABRICATING

A. Comply with ACI 301 chapters and the CRSI Manual of Standard Practice.

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES

A. Maintain reinforcement surfaces free of rust scale and other coatings which might impair concrete bond as described in Section 7.4 of ACI 318.

3.02 PLACING

A. Handle, place and tie reinforcement steel in accord with "Building Code Requirements for Reinforced Concrete", ACI 318 and CRSI publication "Placing Reinforcing Bars," Latest Edition. Comply with ACI 301.

B. Provide Class B tension splices for all splices unless indicated or noted otherwise. Do no splicing of reinforcing steel except as authorized by Architect.

C. Bend bars cold. Do not field bend bars partially embedded in concrete except as specifically permitted by Architect. Do not heat or cut bars with a torch.

D. After vapor barrier or under floor waterproofing, as applicable, for slab-on-grade has been placed, install welded wire fabric per Section 5.4 of ACI 301. Locate welded wire fabric in middle third of slabs. Lap side one full mesh plus 2". Lap ends two full meshes.

3.03 CONCRETE PROTECTION FOR REINFORCEMENT

A. Protect reinforcing by thickness of concrete indicated, in accordance with ACI 318.

B. Where not indicated, thickness of concrete over reinforcing shall be as follows:

1. Where concrete is deposited against the ground without the use of forms – 3 inches.
2. Where concrete is exposed to weather or to ground but placed in forms – 2 inches for bars larger than No. 5 and 1 ½ inches for No. 5 bars or smaller.
3. In slabs and walls not exposed to the ground or to the weather – ¾ inches.

C. Variation from clear cover and depth of members shall conform to section 7.5 of ACI 318.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This section specifies cast-in-place concrete, complete and in place as shown on the drawings, including formwork, reinforcing, mix design, placement procedures, curing, testing and finishing.

B. Concrete paving and walks are specified in Division 2.

C. Pre-cast concrete is specified in other Division 3 sections.

D. Mechanical finishes and concrete floor topping are specified in other Division 3 sections.

1.03 RELATED SECTIONS

A. Section 03305 - Controlled Low Strength Material (CLSM).

B. Section 03200 – Concrete Reinforcement

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Project data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others as requested by the Architect.

C. Concrete mix design for each unique class of concrete in the project.

D. Shop drawings for reinforcement, for fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement for openings through concrete structures and corner bars.

E. Submitted shop drawings must be checked and signed by the General Contractor.

F. Shop drawings for formwork, shoring, and reshoring prepared by a registered Professional Engineer for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

G. Architect's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility.

H. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
1. Fibrous reinforcement
2. Reglet's
3. Waterstops
4. Vapor retarder

I. Laboratory test reports for concrete materials and mix design test.

J. Material certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

K. Minutes of pre-construction conference.

L. Proposed construction joint locations for all structural components.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.

ACI 301-16 - Specifications for Structural Concrete
ACI 315-99 - Standard Practice for Detailing Reinforced Concrete Structures
ACI 318-14 - Building Code Requirement for Reinforced Concrete"
CRSI Manual of Standard Practice

B. Concrete testing services: Owner shall engage a testing laboratory acceptable to Architect to perform material evaluation tests and to design concrete mixes. Testing laboratory shall be currently accredited by C.M.E.C, N.V.L.A.P, or other recognized authority, or the basis of compliance with ASTM C1077. Sampling and testing of concrete to be done by ACI certified field technician Grade 1 personnel or equivalent.

C. Materials and installed work may require testing and re-testing at any time during progress of work. Tests, including re-testing or rejected materials for installed work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for exposed finished concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for unexposed finish concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two (2) edges and one side for tight fit.

C. Shores and struts: Provide positive means of adjustment capable of taking up formwork settlement during concreting.

D. Form coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/1 that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form ties: Factory fabricated, adjustable length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spilling concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.

F. Provide ties that, when removed, will leave holes no larger than one (1) inch diameter in concrete surface.

2.02 REINFORCING MATERIALS

A. Reinforcing bars: ASTM A615, Grade 60, deformed. Deliver to job site bundled, tagged and marked. Store off ground.

B. Steel wire: ASTM A82, plain cold-drawn steel.

C. Welded wire fabric: ASTM A185, welded steel wire fabric. Use sheet stock only for slabs on grade.

D. Welded deformed steel wire fabric: ASTM A497.

E. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar type supports complying with CRSI specifications.

F. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

G. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.03 FIBROUS REINFORCING FOR CONCRETE SLABS

A. Macro Synthetic Fiber: Self-fibrillating polypropylene/polyethylene color blended synthetic macro fibers engineered and designed for use in concrete, complying with ASTM C1116/C 1116M.

B. Macro synthetic fibers with the following typical physical properties:
   1. Specific Gravity: 0.91 - 0.92, Density: 0.91 – 0.92 kg/liter.
   2. Material Properties Tensile Strength: ≤ 70 ksi (CE 480 MPa).
   3. Materials: Virgin Polyolefin (Polypropylene/Polyethylene).
   4. Macro Monofilament and/or Blended Macro/Micro Systems.
   5. Nominal Length: 1.5 inch or 2.25 inch (38 mm or 54 mm).
   6. Rigid ‘Stick Fibers’ not permitted. Fibers are sized to be flexible and not stiff to ensure fibers ‘lay down’ and are easy to finish.

C. Products; subject to compliance with requirements, provide one of the following (or equal):
   1. FRC Industries; FRC HPS-650 or FRC HPS-950 Blend.
   2. Forta Corporation; FORTA FERRO.
   3. Sika Corporation; SikaFiber® Force-950 Blend.
   4. ABC Polymer Industries, LLC – FiberForce 750

D. Fiber Dosage; add macrosynthetic fiber reinforcement at these dosages:
   1. Typical Slab on Grade – 3 pounds yd^3
   2. Mechanical Rooms – 4 pounds yd^3
   3. Topping Slabs – 4 pounds yd^3
   4. Composite Metal Decks – 4 pounds yd^3
   5. Paving – Consult Product Representative.

E. Batching and Mixing:
   1. Add macrosynthetic fiber reinforcement at the prescribed dosage with drum turning, after all or a portion of the concrete has been loaded into the truck or mixer.
   2. After fibers have been added, add water-reducing admixture (polycarboxylate superplasticizer).
   3. Follow ACI procedures to mix 5 minutes once all ingredients are in the drum.

2.04 CONCRETE MATERIALS

A. Portland cement: ASTM C150, Type I or Type II. Use one brand of cement throughout project unless otherwise acceptable to Architect.

B. Fly ash: ASTM C618, Class F or Class C. Do not use for exposed architectural concrete.

C. Normal weight aggregates: ASTM C33 and herein specified. Provide aggregates from a single source for exposed concrete. Maximum aggregate size = 1-1/2″ (1/2″ for topping slabs). For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling causing deleterious substances.

D. Water: Potable

E. Admixtures, general: Provide admixtures for concrete that contain no more than 0.1 percent chloride ions. Calcium chloride shall not be permitted. Admixtures may be used at the option of the Contractor.

F. Air-entraining admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

G. The following admixture may be used at the Contractor's option:

H. Water reducing admixture: ASTM C494, Type A.

I. High-range water reducing admixture (super plasticizer): ASTM C494, Type F or Type G.

J. Water reducing, retarding admixture: ASTM C494, Type D.

2.05 RELATED MATERIALS

A. Waterstops: provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

B. Polyvinyl chloride waterstops: Corps of engineers CRD-C 572

C. 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:

1. The Burke Co.
2. Greenstreak Plastic Products Co.
3. W.R. Meadows, Inc.
4. Progress Unlimited
5. Schlegal Corporation
6. Vinylex Corporation

D. Vapor retarder: Provide vapor retarder cover over prepared base material below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTME154, as follows:

1. Polyethylene sheet not less than ten (10) mils thick.

E. Absorptive cover: Burlap cloth made from jute or kenaf, weighing approximately nine (9) ounces per square yard, complying with AASHTO m 182, Class 2

F. Moisture retaining cover: One of the following, complying with ASTM C171.

1. Waterproof paper
2. Polyethylene film
3. Polyethylene-coated burlap

G. Liquid membrane-forming curing compound: Liquid-type membrane-forming curing compound complying with ASTM C309, Type 1, Class A. Moisture loss not more than 0.055 gr./square centimeter when applied to 200 square feet/gallon. Do not use curing sealing or hardening solutions where fluid applied waterproof coating is to be used.

H. Floor sealer: One of the following.

1. Sikafloor WB-20 by Sika Corporation.
2. GRACE Concrete Seal W by W.R. Grace.
3. EVERCLEAR VOX by Euclid Chemical Co.

I. Bonding compound: Polyvinyl acetate or acrylic base.

J. Epoxy adhesive: ASTM C881, two component materials suitable for use on dry or damp surfaces. Provide material “Type”, “Grade”, and “Class” to suit project requirements.

K. Patching Mortar: Packaged, dry mix complying with ASTM C928 that contains a non-dispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CGM, Incorporated; Pro Trowel Mortar, Pro Gel Mortar, Pro Flowable Mortar or Pro N.B.P.

b. Dayton Superior Corporation; HD-50 or Thin Resurfacer.
c. The Euclid Chemical Company; Concrete Coat, Thin Coat or Verticoat.
d. MBT protection and Repair, Div. Of ChemRex, Inc.; Emaco R320 C1 or Emaco R350 C1.
e. W.R. Meadows, Inc.; Sealtight Meadow-Patch T1 or Sealtight Meadow-Crete FNP.
f. Sika Corporation; SikaTop 121 Plus, Sika Top 122 Plus, Sika Top 123 Plus or Sika Top 126 Plus.
g. Sonneborn, Div. of ChemRex, Inc.; Screed, Sonopatch 100, Sonopatch 200, or Sonopatch 300.
h. Sto Corp., Concrete Restoration Division; Sto Flowable Mortar, Sto Overhead Mortar, Sto Thin Coat Mortar or Sto Trowel-Grade Mortar.
i. Tamms Industries, Inc.; Duraltop Fast Set or Speed Crete PM.
j. ThorRoc, Div. of ChemRex; Inc.; HB2 Repair Mortar or Polyset.

2. Use gels and flowable products for horizontal surfaces. Use mortars and trowelable products for vertical surfaces and bottoms of surfaces.

3. Install products in strict conformance to the manufacturer's instructions. Special attention shall be given to surface preparation and cleaning of surface to be patched.

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301, Chapter 3, Method 1 of 2. If trial batch method is used, use and independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field control testing.

B. Fly ash shall not exceed 25 percent of total cementitious content by weight.

C. Submit written reports to Architect for each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

D. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules.

1. 4,000 psi, 28 day compressive strength; W/C ratio, 0.44 maximum (non-air-entrained), 0.35 maximum (air entrained), minimum 587 lbs. of cement per cubic yard.

2. 3,000 psi, 28 day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air entrained), minimum 517 lbs. of cement per cubic yard.

E. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.07 ADMIXTURES

A. Contractor may use any of the following admixtures in the concrete mix designs in order to meet the specified strength and performance requirements.

B. Contractor may use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete as required for placement and workability.

C. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees Fahrenheit (10 degrees Celsius).

D. Use air entraining admixture in exterior exposed concrete unless otherwise indicated. Add air entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within following limits:

1. Concrete (not exposed to freezing, thawing, or hydraulic pressure) or to receive a surface hardener: 2 percent to 4 percent air.

E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

F. Water cement ratio: Provide concrete for following conditions with maximum water cement (W/C) ratios as follows:

1. Subjected to brackish water, salt spray, or deicers; W/C 0.40

G. Slump limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: not more than three (3) inches.
2. Concrete containing HRWR admixture (superplasticizer): Not more than eight (8) inches after addition of HRWR to site verified two(2) inch to three (3) inch slump concrete.
3. Other concrete: Four (4) inches plus or minus one (1) inch.

2.08 CONCRETE MIXING

A. Ready mix concrete: comply with requirements of ASTM C94, and as specified.

B. When air temperature is between 85 degrees Fahrenheit (30 degrees Celsius) and 90 degrees Fahrenheit (32 degrees Celsius), reduce mixing and delivery time from 1 ½ hours to 75 minutes, and when air temperature is above 90 degrees, Fahrenheit (32 degrees Celsius), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

B. WORKMEN: Contractor to employ adequate number of skilled workmen, including superintendent and foreman to ensure installation in strict accordance with the design.

3.02 FORMS

A. General: design, erect, support, brace and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347. Camber formwork to provide for anticipated deflections. Adjust shores and struts accordingly.

B. Construct forms to size, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

D. Provide temporary openings where interior area of formwork is inaccessible for clean-out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated on the drawings, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for other trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Proposed opening size and location must be submitted to Structural Engineer for review prior to construction.

H. Earth forms: Concrete may be placed directly against sides of footing excavations when acceptable to Architect. When earth forms are acceptable, add one (1) inch to plan dimensions of footings.

I. Cleaning and tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete placement as required to prevent mortar leaks and maintain proper alignment.

J. See ACI 117 for formwork tolerance.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Following leveling and tamping of sub-base for slabs on grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour.

B. Lap joints six (6) inches and seal vapor retarder/barrier joints with manufacturer's recommended mastic and pressure sensitive tape.

3.04 PLACEMENT REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice or "Placing Reinforcing Bars", for details and methods of reinforcement and supports and as herein specified.

B. Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair all tears or punctures with manufacturer's recommended mastic and pressure sensitive tape.

C. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

D. Reinforcing bars shall not be cut or bent in field unless specifically called for on the structural drawings.

E. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as approved by the Architect.

F. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps adjoining widths to prevent continuous laps in either direction. Snip every other wire at control joint locations as shown in the structural drawings. Pull wire up during placement.

H. Minimum cover distances from edge of bar to face of concrete:

1.	Concrete cast against and permanently exposed earth	3″
2.	Concrete exposed to earth weather	
	#6 through #18 bars	2″
	#5 bar and smaller	1 ½″
3.	Concrete not exposed to weather or in contact with ground, slabs, walls, joists	
	#11 bar and smaller	¾″

3.05 JOINTS

A. Construction joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between wall and footings. Accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except otherwise indicated. Do not continue reinforcement through sides of strip placement.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field fabricate joints in waterstops in accordance with manufacturer's printed instructions.

F. Isolation joints in slabs-on-ground: Construct isolation joints in slab-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

G. Joint filler material: Bituminous fiber type conforming to ASTM D1751.

H. Contraction (control) joints in slabs-on-ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by ¼ slab depth or inserts ¼ inch wide by ¼ slab depth, unless otherwise indicated.

I. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

J. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

K. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

L. Joint sealant material is specified in Division 7 Sections of these specifications.

3.06 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Do not relocate or otherwise disturb reinforcing bars.

C. Forms for slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike off templates or compacting type screeds.

3.07 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, non-residual, low-VAC, form-coating compound before reinforcement is placed.

B. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with non-staining, rust preventative material. Rust stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or case in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Place concrete in presence of a qualified concrete inspector from the independent testing laboratory.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

C. Deposit concrete continually or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes or weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. Placing concrete in forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate place layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have not begun to set. At each intersection limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and the embedded items without causing segregation of mix.

G. Use chutes or tremies for placing concrete where a drop of more than six (6) feet is required. Use flow checking devices where drop through tremies exceeds 18 feet.

H. Placing concrete slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items into corners.

J. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement.

L. Hot weather placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and herein specified.

M. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit (32 degrees Celsius). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use liquid nitrogen to cool concrete at Contractor's option.

N. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

O. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

P. Place slabs between dawn and 11:30 a.m. on any day which the temperature is expected to reach 80 degrees Fahrenheit.

Q. Use water reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Architect.

R. Freshly placed concrete shall be protected from damage or injury due to water, falling objects, persons, or anything that might mar, or discolor the concrete finish.

3.09 FINISH OR FORMED SURFACES

A. Rough form finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ¼ inch in height rubbed down or chipped off. (Class B per ACI 347)

B. Smooth form finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, painting, or similar system. This is an as cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. (Class A per ACI 347)

C. Grout cleaned finish: Provide grout cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.

D. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

E. Thoroughly wet concrete surfaces, apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing.

F. Related unformed surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring 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.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

B. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

C. Float finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes and hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.

D. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power units. Check and level surface plane tolerances of Ff18 – fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.

E. Trowel finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint , or other thin film finish coating system.

F. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 – fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.

G. Trowel and fine broom finish: Where ceramic or quarry tile is to be installed with thin set mortar, apply trowel as specified, then immediately follow with slightly scarifying surface by fine brooming.

H. Non-slip broom finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

I. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

J. Non-slip aggregate finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

K. After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

L. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with and evaporation control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven (7) days at 50 degrees minimum.

C. Curing methods: Perform curing of concrete by curing and sealing compound, by moisture retaining cover curing, and by combinations thereof, as herein specified.

D. Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with four (4) inch lap over adjacent absorptive covers.

E. Provide moisture cover curing as follows:

1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape or adhesive.
2. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks and curbs as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

   Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing formed surfaces: Cure formed surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing methods specified above, as applicable.

H. Curing unformed surfaces: Cure unformed surfaces such as slabs, floor topping, and other flat surfaces, by application of appropriate curing method.

I. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover, unless otherwise directed.

J. Floor sealer: Seal concrete slabs to be exposed to view in the completed structure with floor sealer product.

3.12 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring.

B. Extend shoring from ground to roof for structures four (4) stories or less, unless otherwise permitted.

C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

D. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28 day strength and heavy loads due to construction operations have been removed.

3.13 REMOVAL OF FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of work, may be removed after cumulatively curing not less than 50 degrees Fahrenheit (10 degrees Celsius) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained 100 percent of design minimum compressive strength of cast-in–place concrete by testing field cured specimens representative of concrete location members.

C. Form-facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.14 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be accepted for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Architect.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling in: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in –place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and 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 to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Reinforced masonry: Provide masonry grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.16 CONCRETE SURFACE REPAIRS

A. Patching defective areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect, and at no additional cost to owner.

B. Cut out honeycomb, rock pockets, voids over ¼ inch in any dimension and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

C. For expose-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

D. Repair of formed surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects as such include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of unformed surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.

G. Correct high areas in unformed surfaces by grinding after concrete after concrete has cured at least 14 days.

H. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend in to adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

I. Repair defective areas, except random cracks and single holes not exceeding one (1) inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾ inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

J. Repair isolated random cracks and single holes not over one (1) inch in diameter by dry pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a #16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack before bonding compound has dried. Compound dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

K. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing laboratory to perform tests and to submit test reports. Testing Agency shall be subject to approval by the Architect. The Contractor is to notify the Testing Agency of scheduled concrete placements in sufficient time to allow the inspector to verify reinforcing steel placement and to observe the concrete placement.

B. Sampling and testing for quality control during placement of concrete may include the following , as directed by Architect.

C. Sampling fresh concrete: ASTM C172, except modified for slump to comply with ASTM C94.

D. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

E. Air content: ASTM C173; volumetric method for light weight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

F. Concrete temperature: Test hourly when air temperature is 40 degrees Fahrenheit (4 degrees Celsius) and below, when 80 degrees Fahrenheit (27 degrees Celsius) and above, and each time a set of compression test specimens are required.

G. Compression test specimen: ASTM C31; one set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required.

H. Compressive strength tests: ASTM C39; one set for each day's pour exceeding five (5) cubic yards plus additional sets for each 50 cubic yards more than the first 25 cubic yards for each concrete class placed in any one day; one specimen tested at seven (7)

days, two specimens tested at twenty-eight (28) days, and one specimen retained in reserve for later testing if required.

I. When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.

J. When total quantity of a given class of concrete is less than 50 cubic yards, Architect may waive strength test if adequate evidence of satisfactory strength is provided,

K. When strength of field cured cylinder is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

L. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength tests results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

M. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive breaking strength, and type of break for both seven (7) day tests and 28 day tests.

N. Non-destructive testing: Impact hammer, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

O. Additional tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION

SECTION 03930
CONCRETE REHABILITATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. This Section includes the following:

1. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
2. Floor joint repair
3. Epoxy crack injection
4. Corrosion-inhibiting treatment
5. Polymer overlays
6. Polymer sealers
7. Steel structural reinforcement.
8. Composite structural reinforcement.

1.03 RELATED SECTIONS

A. Section 01732 - Selective Demolition.

B. Section 03300 - Cast-in-Place Concrete.

C. Section 07180 - Water Repellents: For clear penetrating and film-forming water repellents applied to concrete.

1.04 UNIT PRICES

A. Unit prices include the cost of preparing existing construction to receive the work indicated [and costs of field quality-control testing required by the Work for which the unit price applies].

B. Concrete Removal and Replacement or Patching: Work will be paid for by the cubic foot computed on the basis of rectangular solid shapes approximating the actual shape of concrete removed and replaced with average depths, widths, and lengths, measured to the nearest inch.

1. Reinforcing bar replacement will be paid for separately by the pound of replacement steel with welded and mechanical splices paid for by the unit.

C. Epoxy Crack Injection: Work will be paid for by the linear foot of crack injected.

D. Polymer Overlays: Work will be paid for by the square foot of exposed overlay surface.

E. Composite Structural Reinforcement: Work will be paid for by the square foot of composite material applied.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data and mixing preparation and application instructions

B [Formwork] [and] [Shoring] Drawings Prepared by or under the supervision of a qualified professional engineer detailing [formwork] [and]. [temporary shoring and supports]. Include schedule and sequence for erection and removal relative to removal of deteriorated concrete and reinforcement and subsequent repair and reinforcement

C. Samples: Cured Samples of [overlay] [and] [patching] materials.

D. Qualification Data: For [installers] [professional engineer] [manufacturers] [and] [testing agency].

1. For products required to be installed by workers approved by product manufacturers, include letters of acceptance by product manufacturers certifying that installers are approved to apply their products.

E. Material Certificates: For each type of product indicated, signed by manufacturers.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for [bonding agents] [patching mortars] [epoxy adhesives] [and] [composite structural reinforcement].

G. Rehabilitation Program: For each phase of rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request complying with Division I Section 'Product Requirements" and provide a written description of proposed materials and methods including evidence of successful use on other comparable projects and a testing program to demonstrate their effectiveness for this Project.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer that employs workers trained and approved by manufacturer to apply [corrosion-inhibiting treatments] [concrete patching and rebuilding materials] [epoxy crack injection materials] [polymer overlays] [polymer sealers] [and] [composite structural reinforcement].

B. Manufacturer Qualifications: Manufacturer that employs factory-trained representatives who are available for consultation and Project-site inspection

C. Source Limitations: Obtain [concrete patching and rebuilding materials] [epoxy crack injection materials] [and] [composite structural reinforcement materials][each] through one source from a single manufacturer

D Mockups Build mockups for [concrete removal and patching] [floor joint repair] [epoxy crack injection] [polymer overlays] [polymer sealers] [and] [composite structural reinforcement] 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

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

C. Store cementitious materials off the ground, undercover, and in a dry location.

D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

1.08 PROJECT CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing store mixed products in shade and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

I. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within 8 hours.

2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within 8 hours

3 Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F for 8 hours.

B Cold-Weather Requirements for Cementitious Materials Do not apply unless air temperature is above 40 deg F and will remain so for at least 48 hours after completion of Work

C. Cold-Weather Requirements for Cementitious Materials: Comply with the following procedures

1. When air temperature is below 40 deg F, heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F.

2 When mean daily air temperature is between 25 and 40 deg F cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.

3. When mean daily air temperature is below 25 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.

D. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.

E Environmental Limitations for High-Molecular-Weight Methacrylate Sealers Do not apply when concrete surface temperature is below 55 deg F or above 75 deg F. Apply only to substrates that have been dry for at least 72 hours

PART 2 - PRODUCTS

2.01 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film ‘on steel reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Corr-Bond; The Euclid Chemical Company, Cleveland, Ohio.
   b. Surepoxy HM EPL; Kaufman Products, Inc., Baltimore, Maryland.
   c. Armatec 110 EpoCem; Sika Corporation, Lyndhurst, New Hampshire.
   d. Sonoprep; Sonneborn, Div. of ChemRex, Shakopee, Minnesota.
   e Sto Bonding and Anti-Corrosion Agent Sto Corp, Concrete Restoration Division Atlanta Georgia
   f Duralprep A C, Tamms Industries, Inc Kirkland, Illinois

B Epoxy Bonding Agent ASTM C 881/C 881 M Type [II] [V]

1. Products Subject to compliance with requirements, provide one of the following:
   a. Anti-Hydro International, Inc.; Poly-Epoxy Bonding #100.
   b. ChemCo Systems; CCS Bonder Liquid, [LWL] [dri [SWL].
   c. Dayton Superior Corporation; [Resi-Bond (J-58)] [Sure-Anchor Epoxy (J-50),] [or] [Sure-Inject (J-56)].
   d. Euclid Chemical Company (The); [Euco #352 Epoxy System] [Euco #452 Epoxy System] [or] [Euco #620 Epoxy System]
   e. Kaufman Products, Inc.; SurePoxy HM. EPL.
   f MBT Protection and Repair, Div of ChemRex Concresive Liquid LPL
   g. Meadows, W. R., Inc.; [Sealtight Rezi-Weld 1000] [Sealtight Rezi-Weld Gel Paste] [Sealtight Rezi-Weld Gel Paste State] [or] [Sealtight Rezi-Weld LVJ
   h. Sika Corporation; [Sikadur 31, Hi-Mod Gel] [Sikadur 32, Hi-Mod] [Sikadur 32, Hi-Mod LPL] [Sikadur 35, Hi-Mod LV] [or] [Sikadur 35, Hi-Mod LV LPL].
   i. Sonneborn, Div. of ChemRex; [Epogel] [or] [Epogrip].
   j.. Tamms Industries, Inc.; Duralbond.
   k. ThoRoc, Div. of Chem Rex; Epoxy Adhesive 24LPL.
   I. Unitex; [Pro-Poxy 204] [on [Slow Set Bonding. Agent].
   m. US MIX Products Company; [US Spec Maxi - Bond 2500] [on [US Spec Slow Bond 6500].

C. Latex Bonding Agent: ASTM C 1059, Type [I] [II] [II at exterior locations and where indicated, Type I at other locations].

1. Products: Subject to compliance with requirements, provide one of the following:

a. Latex Bonding Agent, Type I:

1) Euclid Chemical Company (The); Euco Weld.
2) Kaufman Products, Inc.; Sureweld.
3) Meadows W R Inc lntnalok
4) Sika Corporation; Sikalatex.
5) US MIX Products Company; US Spec Bondcoat.

b. Latex Bonding Agent, Type II:

1) Dayton Superior Corporation; Day-Chem Ad Bond (J-40).
2) Euclid Chemical Company (The); Flex-Con.
3) Kaufman Products, Inc.; Surebond.
4) Meadows, W. R. Inc.; Sealtight Acry-Lok.
5) Sonneborn Div of ChemRex Acrylic Additive
6) US MIX Products Company; US Spec Acrylcoat.

D Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150 Type I, II or III and 1 part fine aggregate complying with ASTM C 144 except 100 percent passing a No 16 sieve

2.02 PATCHING MORTAR

A. Patching Mortar, General:

1. Unless otherwise indicated use any of the products specified in this Article
2. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
3. Coarse Aggregate for Adding to Patching Mortar:, Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.

B. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.

C. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cementitious Patching Mortar:

1) Kaufman Products, Inc.; Hicap.
2) MBT. Protection and Repair, Div. of ChemRex; [Emaco S66 Cl] [Emaco S77 Cl] [or] [Emaco S88 Cl].
3) Sika Corporation; [Sikarepair 223] [or] [Sikarepair SHB].
4) Sonneborn, Div. of ChemRex; Deep Pour Mortar.
5) Sto Corp., Concrete Restoration Division; Sto Full-Depth RepairMortar.
6) ThoRec, Div. of ChemRex; LA Repair Mortar.

b. Cementitious Patching Mortar, Rapid Setting:

1) CGM, Incorporated; Pro Patching Cement.
2) Dayton Superior Corporation [Day-Chem Perma Patch] [Re-Crete 5 Minute] [or] [Re-Crete 20 Minute]

3) Euclid Chemical Company (The) Euco-Speed
4) Fox Industries Inc FX-928 Rapid Hardening Mortar
5) Kaufman Products, Inc.; Duracrete.
6) Meadows W R Inc [Sealtight Meadow-Patch 5] [Sealtight Meadow-Patch 20] [or] [Sealtight Futura-15].
7) Sika Corporation; Sikaset Roadway Patch.
8) Sonneborn, Div. of ChemRex; Road Patch.
9) Sto Corp., Concrete Restoration Division; Sto Rapid Repair Mortar.
10) Tamms Industries, Inc.; Speed Crete 2028.
11) ThoRoc Div of ChemRex, [10-60 Rapid Mortar] [or] [10-61 Rapid Mortar]
12) Unitex; Patch Set 928.
13) US MIX Products Company, US Spec Transpatch
14) Watson Bowman Acme Corp., Degussa ,AG; Wabo Renew 100.

D. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a[non-redispersible] latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AQUAFIN, Inc.; MORTAR-40.
   b. CGM, Incorporated; [Pro Trowel Mortar.] [Pro Gel Mortar.] [Pro Flowable Mortar] [Pro N B P]
   c. Dayton Superior Corporation; [HD ~ 50]:[on] [Thin Resurfacer].
   d. Euclid Chemical Company (The), [Concrete Coat] [Thin Coat] [or] [Verticoat].
   e. Fox Industries, Inc.; [FX-243] [or] [FX-273] Trowel Grade' Polymer Repair Mortar.
   f. Kaufman Products, Inc.; [Patchwell] [Patchwell Kit] [Patchwell Kit 0] [or] [Patchwell Kit HB].
   g. MBT Protection and Repair, Div. of ChemRex; [Emaco R320 CI] [or] [Emaco R350 Cl].
   h. Meadows, W. R., Inc.; [Sealtight Meadow-Patch TI] [or] [Sealtight Meadow-Crete FNP}.
   i. Sika Corporation; [SikaTop 121 PIus] [SikaTop 122 Plus] [SikaTop 123 PIus] [or] [SikaTop 126 PIus].
   j. Sonneborn, Div. of ChemRex; [Screed] [Sonopatch 100] [Sonopatch 200] [Sonopatch 300].
   k. Sto Corp., Concrete Restoration Division; [Sto Flowable Mortar] [Sto Overhead Mortar] [Sto Thin-Coat Mortar] [or] [Sto Trowel-Grade Mortar].
   I. Tamms Industries, Inc.; [Duraltop Fast Set] [or] [Speed Crete PM].
   m. ThoRoc, Div. of ChemRex, Inc.; [HB2 Repair Mortar] [or] [Polyset].
   n. US MIX Products Company; [US Spec Polypatch FR] [01 [US Spec Thinpatch].

E. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a [non-redispersible]latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Products: Subject to compliance with requirements, provide one of the

following:

a. Euclid Chemical Company (The); Verticoat Supreme.
b. Fox Industries, Inc.; [FX-261 Polymer Repair Mortar] [or] [FX-286].
c. MBT Protection and Repair, Div. of ChemRex; Emaco S88 CI.
d. Meadows, W. R., Inc.; [Sealtight Meadow-Crete H2] [or] [Sealtight Meadow-Crete-Gp5}
e. Sika Corporation; Sika Monotop 615.
f. Sonneborn, Div. of ChemRex; [Gel Patch] [Sonopatch 200] [or] [Sonopatch 300]. :' ." ~, '
g US Mix Products Company, US Spec V/O Patch

2.03 CONCRETE

A. Concrete Materials and Admixtures: Comply with Section 03300 - Cast-in-Place Concrete.

B. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Section 03200 — Concrete Reinforcement.

C. Form-Facing Materials: Comply with Section 03100 — Concrete Formwork.

D. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S, with [95 to 100 percent passing a 1-1/2-inch sieve, 40 to 80 percent passing a 1-inch sieve, 20 to 45 percent passing a 3/4-inch sieve, 0 to 10 percent passing a 1/2-inch sieve, and 0 to 2 percent passing a 3/8-inch sieve] [100 percent passing a 1-1/2-inch sieve, 95 to 100 percent passing a 1-inch sieve, 40 to 80 percent passing a 3/4-inch sieve, 0 to 15 percent passing a 1/2-inch Sieve, and 0 to 2 percent passing a 3/8-inch sieve].

E. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 sieve, 95 to 100 percent passing a No. 16 sieve, 55 to 80 percent passing a No. 30 sieve, 30 to 55 percent passing a No. 50 sieve, 10 to 30 percent passing a No. 100 sieve, 0 to 10 percent passing a No. 200 sieve, and having a fineness modulus of 1.30 to 2.10.

F. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.

G. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.

H Pozzolans for Grout Used with Preplaced Aggregate ASTM C 618

2.04 MISCELLANEOUS MATERIALS

A. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.

1. Products: Subject to compliance with requirements, provide one of the following:
   a.. Anti-Hydro International, Inc.; Groove & Crack Filler #250.
   b. ChemCo Systems; CCS Grout, [Control Joint] [or] [Control Joint -H B]. .
   c. Euclid Chemical Company (The); Euco [700] [or] [800].
   d. Kaufman Products, Inc.; Surepoxy Flexijoint.
   e. MBT Protection and Repair, Div. of ChemRex ~ Master-fill 300i.
   f. Meadows, W. R., Inc.; Sealtight Rezi-Weld Flex.

g. Sika Corporation; [Sikadur 51 NS] [or] [Sikadur 51 SL]. Unitex [Pro-Flex] [or] [Pro-Flex Gel]
h. US Mix Products Company US Spec SR 50 - EJF

B Polyurea Joint Filler 2-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 per ASTM 0 2240

1. Products: Subject to compliance with requirements provide one of the following:
   a. ASTC Polymers; Penetron 3003.
   b. ChemCo Systems; CCS Grout, Polyurea [Control Joint] [or] [SWL].
   c. Dayton Superior Corporation; Joint Saver II.
   d. Euclid Chemical Company (The); Euco Qwikjoint 200.
   e. MBT Protection and Repair, Div. of Chem Rex; Masterfill 400 CT.
   f. Sonneborn, Div. of ChemRex; Sonolastic TF-100.

C. Epoxy Crack Injection Adhesive: ASTM C 881/C 881 M, Type [I,] [IV,] [Grade 1,] [except for gel time,] [solvent free].

1. Products: Subject to compliance with requirements, provide one of the following:
   a. ChemCo Systems; CCS Grout, [Standard] [Standard - High Ambient Temperature] [or] [Low Viscosity].
   b. Dayton Superior Corporation; [Resi-Bond (J-58)] [Sure-Anchor Epoxy (J-50)] [or [Sure-Inject (J-56)].
   c. Euclid Chemical Company (The); [Euco #352 Epoxy System] [Euco #452 Epoxy System] [Euco #620 Epoxy System] [Euco #452 LV] [Euco #620 LV] [or] [Eucopoxy Injection Resin].
   d. Kaufman Products, Inc.; [Surepoxy HMLV] [Surepoxy HMLV-Class B] [or] [Surepoxy HM-SLV].
   e. MBT Protection and Repair, Div. of ChemRex; [Concresive Standard LVI] [or] [SCB Concresive 1380].
   f. Meadows, W. R., Inc.; Sealtight Rezi-Weld LV.
   g. Sika Corporation; [Sikadur 35, Hi-Mod LV] [Sikadur 35, Hi-Mod LV .LPL] [Sikadun 52] [or] [Sikadur Injection Gel].
   h. Sonneborn, Div. of ChemRex; [Epofil] [Or] [Epofil SLV].
   i. Tamms Industries, Inc.; Duralcrete LV.
   j. Thermal-Chem; Crack Injection, Product [2] [205] [or] [212].
   k. ThorRoc, Div. of ChemRex, Inc.; {LV300 Injection Resin] [or] {ULV14O Injection Resin].
   I. Unitex; [Pro-Poxy 50 SuperLV] [Pro-Poxy 100 LV] [or] [Slow Set Injection Resin].
   m. US MIX Products Company; US Spec Maxi - Bond 500LV.

D. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer

E Corrosion-Inhibiting Treatment Materials Water-based solution of alkaline corrosion-inhibiting chemicals that penetrates concrete by diffusion and forms a protective film on steel reinforcement.

1. Products Subject to compliance with requirements provide one of the following:
   a Cortec Corporation [MCI 2005] [or] [MCI 2020]
   b. Cox Industries, Inc.; FX-361 Migratory Corrosion Inhibitor.

c. Sika Corporation; Sika Ferrogard 903.
d. Sonneborn, Div. of ChemRex; Corrosion Inhibitor.

F. Polymer Overlay: Epoxy adhesive complying with ASTM C 881/C 881 M, Type III

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Kaufman Products, Inc.; [Surepoxy VLM] [or] [Surepoxy VLM Class B]
   b. Meadows, W. R., Inc.; Sealtight Rezi-Weld Type III DOT.
   c. Themial-Chem; Flexgard T, Product 309.
   d. Unitex; Pro-Poxy Type Ill D ~ O.T.
   e. US MIX Products Company; US SPEC Type Ill Epoxy Binder.

G. Aggregate for Use with Polymer Overlay: Oven-dried, washed silica sand complying with ACI 503.3.

H. Polymer Sealer: Low-viscosity [epoxy] [or] [high-molecular-weight methacrylate] penetrating sealer recommended by manufacturer for application to exterior concrete traffic surfaces.

1. Products: Subject to compliance .with requirements, provide one of the following:
   a. Epoxy Sealers:
      1) ChemCo Systems; CCS Coating, Epoxy Healer Sealer.
      2) Euclid Chemical Company (The); Euco #512 Epoxy Sealer.
      3) Fox Industries, Inc.; FX-452 Epoxy Penetrating Sealer.
      4.) Kaufman Products, Inc.; SurePoxy Penetrating Sealer.
      5) MBT Protection and Repair, Div. of ChemRex; Masterseal GP.
      6) Thermal-Chem; Hairline Crack Sealer, Product 207.
      7) Unitex; Pro-Seal HS.
      8) US MIX Products Company; US Spec Eposeal LVS.
   b. High-Molecular-Weight Methactylate Sealers:
      1) Meadows, W. R. Inc.; Sealtight Vocomp-25.
      2) Sika Corporation; Sikapronto 19.
      3) Transpo Industries, Inc.; Sealate T70.

I. Methylmethacrylate Sealer/Brighteners: Clear low-viscosity sealer recommended by manufacturer for sealing exterior exposed-aggregate concrete, and formulated to bring out color of aggregates and give concrete a wet look.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dayton Superior Corporation; [Day-ChemAggre-Gloss (J-25)] [or] [Safe Seal Heavy Duty (J-24 HD)]
   b Kaufman Products Inc, [Sureal] [or] [Sureal Emulsion].
   c Meadows W R, Inc , Sealtight CS-309-25
   d. Tamms Industries, Inc.; Luster Seal 300.
   e. Unitex; Bright Rock Sealer.
   f. US MIX Products Company; [US Spec BRS-25] [or] [US Spec Radiance UV-25]

J Steel Plates Shapes and Bars ASTM A 36/A 36M

1. After fabricating, prepare surfaces to comply With SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. After preparation, apply one coat of lead- and chromate-free, modified-alkyd

primer complying, with MPI#76 and one coat of alkyd-g loss enamel complying with MPI#96.

3. After preparation, apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build, urethane or epoxy coating recommended by manufacturer for application oven specified zinc-rich primer. Comply with coating manufacturer's written directions and with requirements in SSPCPA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/l9 and M74/M75 Aliphatic Acrylic Urethane Semi-Gloss.
      2) Carboline Company; Carbozinc 621 and Carboguard 890 2-Component Epoxy.
      3) ICI Devoe Coatings; Catha-Côat 313 and Devthane 378 Aliphatic Urethane Semi-Gloss Enamel
      4) International Coating's Limited; lnterzinc 315 Epoxy Zinc-Rich Primer and Interthane 870.
      5) PPG Architectural Finishes, Inc; Aquapon Zinc-Rich Primer ABC 97-670 and Aquapon 97-I 30 Epoxy.
      6) Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer and Macropoxy HS High Solids Epoxy.
      7) Tnemec Company, Inc.; Tneme-Zinc 90-97 and Series 27 Hi-Build Epoxy.

K. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A, for bolts; ASTM A 563, Grade A, for nuts; and ASTM F 436 for washers; hot-dip or mechanically zinc coated.

L. Postinstalled Anchors: [Chemical] [or] [expansion] anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594 Alloy Group 1 or 2 for bolts and nuts, ASTM A 666 or ASTM A 276 Type 304 or 316 for anchors with capability to sustain without failure a load equal to four times the load imposed as determined by testing per ASTM E 488 conducted by a qualified independent testing agency

M. Composite Structural Reinforcement: Manufacturer's system consisting of [carbon] [glass]-fiber reinforcement in the form of [preimpregnated sheets] [or] [tow sheet with field-applied saturant], and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as external structural reinforcement for concrete.

1. Products Subject to compliance with requirements provide one of the following:
   a. Sika Corporation; Carbodur and Sikadur 30.
   b. Sumitomo Corporation of America; Replark.
   c. Thermal-Chem; Epic Systems.
   d. VSL (VStructural, LLC), a Structural Group Company; V-Wrap ICI 00] [on] [C200].
   e. VSL (VStructural, LLC), a Structural Group Company; V-Wrap EG5O.
   f. Watson Bowman Acme Corp., Degussa AG; Wabo MBrace.

2.05 MIXES

A. Mix products, in clean containers, according to manufacturer's written instructions.

1. Add clean silica sand and coarse aggregates to products only as recommended

by manufacturer.

2. Do not add water, thinners, or additives unless recommended by manufacturer.

3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities on use shovel or trowel as unit of measure.

4 Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

B. Mortar Scrub-Coat: Mix with enough water to provide consistency of thick cream.

C. Dry-Pack Mortar: Mix with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with Section 03300 - Cast-in-Place Concrete.

E. Grout for Use with Preplaced Aggregate:' Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate

PART 3 EXECUTION

3.01 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated on delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries[as directed by Architect] At columns and walls make boundaries level and plumb, unless otherwise indicated.

C. Locate at least three reinforcing bars using a pachomoter, and drill test holes to determine .depth of cover. Calibrate pachometer, using depth of coven measurements, and verify depth of cover in removal areas using pachometer.

3.02 PREPARATION

A. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.

1. Erect and maintain temporary protective covers oven pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of, tightly fitted, 3/4-inch exterior-grade plywood supported at 16 inches o.c. and covered with asphalt roll roofing.

2. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape[or a liquid strippable masking agent]. If practical, remove items, store, and reinstall after potentially damaging operations are complete.

3. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off Owner's property.
4. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
5. Collect runoff from wet operations and dispose of by legal means off Owner's property.

B. Shoring: Install temporary supports before beginning concrete removal.

C. Concrete Removal:
1. Saw-cut perimeter of areas indicated for removal to a depth of at least .1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than coven on reinforcement
2. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
3. Remove additional concrete, if necessary, to provide a depth of removal of at least. 1/2 inch over entire removal area.
4. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded remove concrete from entire perimeter of bar and to provide at least a 3/4-inch clearance around bar.
5. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
6.. Provide fractured aggregate surfaces with a profile of at least 1/8 inch that are approximately perpendicular on parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level, unless otherwise directed.
7. Thoroughly clean removal areas of loose concrete, dust, and debris.

D. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by [high-pressure water cleaning] [abrasive blast cleaning] [needle scaling] [or] [wire brushing] until only tightly bonded light rust remains.
1. Where section loss of reinforcing ban is more than 25 percent, or 20 percent in 2 on more adjacent bars, cut bars and remove and replace [as directed by Architect]. Remove additional concrete as necessary to provide at least 3/4-inch clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318, by lapping, welding, on using mechanical couplings.

E. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than [3/4 inch] [1 inch] [2 inches] deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

F. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete by [low-pressure water cleaning] [detergent scrubbing] [or] [sand blasting] to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment. '

G. Surface Preparation for Overlays: [Remove delaminated material and deteriorated concrete surface material.]Roughen surface of concrete by, [sand blasting] [shot blasting] [scarifying] [needle scaling] [high-pressure water jetting] [scabbling] [flame blasting] [or] [milling] to produce a surface profile matching CSP [3] [4] [5] [6] [7] [8] [9] per ICRI 03732 Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning

H. Surface Preparation for Sealers: Clean concrete by [shot blasting] [low-pressure water. cleaning] [or] [detergent scrubbing] to remove dirt, oils, films, and other materials detrimental to sealer application.

I. Surface Preparation for Sealers Acid etch surface of concrete to produce a surface profile. matching CSP 1 per ICRI 03732.[Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.]

1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
4. When pH is acceptable and surface is clean, vacuum dry.

J. Surface Preparation for Composite Structural Reinforcement: [Remove delaminated material and deteriorated concrete surface material.]Clean concrete where reinforcement and epoxy patching mortar is to be applied by [low-pressure water cleaning] [on] [detergent scrubbing] to remove dirt, oils, films, and other materials detrimental to epoxy application. Roughen surface of concrete by sand blasting.

3.03 APPLICATION

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars [and concrete]by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or-concrete.

C. Epoxy Bonding Agent: Apply to reinforcing bars[and concrete] by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. [Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat.]Apply patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar on concrete.

D. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Apply patching mortar or concrete while bonding agent is still wet. If bonding agent 'dries, recoat before placing patching mortar or concrete.

E. Latex Bonding Agent, Type I: Apply to concrete by brush roller on spray. Allow to dry before placing patching mortar or concrete.

F. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches beyond

repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area If scrub-coat dries recoat before applying patching mortar or concrete.

G Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:

1. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar[mixed with latex bonding agent] into substrate filling pores and voids.
2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
3. For vertical patching, place material in lifts of' not more than [1 inch] [1-1/2 inches] [2 inches] [3 inches] nor less than [1/8 inch] [1/4 inch]. Do not feather edge:
4. For overhead patching, place material in lifts of not more than [1 inch] [1-1/2 inches] [2 inches] non less than [1/8 inch] [1/4 inch]. Do not feather edge.
5. After each lift is placed, consolidate material and screed surface.
6. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
7. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a [smooth] [rough] surface with a [wood or sponge float] [broom. or burlap drag].
8. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

H. Dry-Pack Mortar: Use for deep cavities[and where indicated]. Unless otherwise recommended by manufacturer, apply as follows:

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.
3. Place dry-pack mortar into cavity by hand, and compact into place with a hardwood drive stick and mallet on hammer. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
4. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
5. Wet-cure patch for not less than seven days by water-fog spray or water saturated absorptive cover.

I. Concrete: Place according to Division 3 Section Cast-in-Place Concrete and as follows:

1. Apply [epoxy-modified cementitious bonding and anticorrosion agent] [epoxy bonding agent] to reinforcement[and concrete substrate].
2. Apply [latex bonding agent] [Type I, latex bonding agent] [mortar scrub-coat] to concrete substrate.
3. Use vibrators to consolidate concrete as it is placed.

4. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
5. [Where indicated] place concrete by form and pump method.
   a. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and junctions of forms with existing concrete.
   b. Pump concrete into place, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi.
6. Wet-cure concrete for not less than seven days by leaving forms in place on keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

J. Grouted Preplaced Aggregate Concrete: Use [for column and wall repairs] [where indicated]. Place as follows:
1. Voids with patching mortar Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and junctions of forms with existing concrete.
2. Apply [epoxy-modified, cementitious bonding and anticorrosion agent] [epoxy bonding agent] to reinforcement[and concrete substrate].
3. Place aggregate in forms, consolidating aggregate as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
4. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.
5. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi.
6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover
7. Repair and finish to match surrounding concrete.

K Joint Filler Install in nonmoving floor-joints where indicated
1. Install filler-to a depth of at least [3/4inch] [1 inch] [2 inches]. Use fine silica sand no more than .1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible filler-s below joint filler.
2 Install filler so that when cured,, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

L. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:
1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther- apart than thickness of member being injected. Seal injection ports in place with capping adhesive.

3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider-than crack.
4. Inject cracks wider than 0.003 inch to a depth of 8 inches or to a width of less than 0.003 inch, whichever is less.
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

M. Corrosion-Inhibiting Treatment: Apply by brush, roller-, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete[or applying a sealer or overlay].
1. Apply to the following: <Insert locations where treatment is to be applied.>

N. Polymer Overlay: Apply according to ACI 503.3.
1. Apply to traffic-bearing surfaces, including parking areas and walks.

O. Polymer Sealer: Apply by brush, roller, on airless spray at manufacturer's recommended application rate.
1. Apply to traffic-bearing surfaces, including parking areas and walks.

P. Methylmethacrylate Sealer/Brighteners: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.
1. Apply to exterior concrete surfaces that are exposed to view, excluding traffic-bearing surfaces

Q. Composite Structural Reinforcement Using Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, apply as follows:
1. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
2. Apply epoxy adhesive to a thickness of 1/16 inch to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
3. Clean preimpregnated fiber sheet with acetone or- other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch.
4. Apply adhesive-coated fiber sheet to adhesive-coated concrete within open time of epoxy adhesive, and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
5. Apply additional layers as indicated using same procedure.

R. Composite Structural Reinforcement Using Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, apply as follows:
1. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
2. After primer- has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
3. Apply epoxy saturant to [fiber tow sheet] [or] [primed and patched surface] with 3/8-inch nap roller. Apply fiber tow' sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper

backing from fiber tow sheet and apply additional epoxy as needed to fully saturate tow sheet.

4. Apply additional layers as indicated, fully saturating each with epoxy.
5. After saturant has cured, apply protective topcoat by [brush] [roller] [on] [spray].

3.04 FIELD QUALITY CONTROL

A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to sample materials and perform tests as follows:

1. Patching Mortar-, Packaged Mixes: <Insert number> randomly selected samples tested according to ASTM C 928.
2. Patching Mortar, Field Mixed: <Insert number> randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
3. Concrete: As specified in Division 3 Section "Cast-in-Place Concrete."
4. Shotcrete: As specified in Division 3 Section "Shotcrete."
5. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.
   a. Testing Frequency: One sample for each 25 cu. yd. of grout or fraction thereof, but not less than one sample for each day's work.
6. Joint Filler: Core drilled samples to verify proper installation..
   a. Testing Frequency: One sample for each 100..feet of joint filled.
   b. Where samples are taken, fill holes with joint filler.
7. Epoxy Crack Injection: Core drilled samples to verify proper installation.
   a. Testing Frequency: [3 samples from mockup and]1 sample for each 100 feet of crack injected.
   b. Where samples are taken, fill holes with epoxy mortar.

END OF SECTION

SECTION 04200
UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This section includes the following:

1. Concrete unit masonry

1.03 RELATED SECTIONS

A. Division 3 Section: "Cast-in-Place Concrete"

B. Products installed but not furnished under this Section include the following:

1. Steel lintels in unit masonry are specified in Division 5 Section, "Metal Fabrication".
2. Wood nailers and blocking built into unit masonry are specified in Division 6 Section, "Rough Carpentry".
3. Reglets in masonry joints for metal flashing are specified in Division 7 Section, "Flashing and Sheet Metal".
4. Hollow metal frames in unit masonry openings are specified in Division 8 Section, "Hollow Metal Doors and Frames".

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm):

1. f'm = 1,500 psi on net area., U.N.O.

1.05 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Section.

1. Product data for each different masonry unit, accessory, pre-mixed mortar, pre-mixed masonry grout and other manufactured product indicated.
2. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
3. Submitted shop drawings must be checked and signed by the General Contractor.
4. Material certificates signed by manufacturer and Contractor certifying that each type of masonry unit complies with requirements specified in referenced unit masonry standard, including fire performance characteristics.
5. Hot weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

6. Results from tests and inspections performed by Owner's representatives will be reported promptly and in writing to Architect and Contractor.
7. Mix designs for ready mix masonry grout showing the proportions of all materials and compression test reports for the mix.

1.06 QUALITY ASSURANCE

A. Unit masonry standard: TMS 402/602-16 "Building Code Requirements and Specification for Masonry Structures.

B. Fire performance characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistances has been determined per ASTME119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

C. Single source responsibility for masonry units: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from the manufacturer for each cementitious component and from one source and producer for each aggregate.

D. The contractor shall retain a qualified testing laboratory to perform the following tests:
1. Sample and test grout in accordance with ASTMC1019 for each 5,000 square foot of masonry.
2. Slump tests – ASTMC143

E. When requested by the Architect/Engineer, the Contractor shall retain a qualified testing laboratory to perform a masonry prism test in accordance with ASTME447, Method B, modified as follows:
1. Prisms shall be stack bond, one unit long and thick with a full mortar bed.
2. Limit height/thickness ratio from 1.33 – 5.00.
3. Provide a minimum of one joint.

One set of three (3) prisms prior to construction and during construction for each 5,000 square feet of wall.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry material to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover, and in a dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 PROJECT CONDITIONS

A. Protection of masonry: During erection, 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.

B. Extend cover to minimum of 24 inches down both sides and hold cover securely in place.

C. Where one wythe of multi-wythe 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.

D. Do not apply uniform floor or roof loads for at least 12 hours and concentrate loads for at least three (3) days after building masonry walls or columns.

E. Stain prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.

F. Protect base of walls from rain splashed mud and mortar splatter by means of covering spread on ground and over wall surface.

G. Protect sills, ledges, and projections from mortar droppings.

H. Protect surfaces of window and door frames, as well as similar products with painted and integral finish from mortar droppings.

I. Hot weather construction: Comply with referenced unit masonry standard.

PART 2 - GENERAL

2.01 MATERIALS - GENERAL

A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

B. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

C. Concrete masonry units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

D. Provide non-moisture controlled units.

E. Exposed faces: Manufacturer's standard color and texture, unless otherwise indicated.

F. Hollow load-bearing concrete masonry units: ASTMC90 and as follows:

1. Unit compressive strength: Provide units with minimum average net area compressive strength 1500 psi, average of 3 units.

G. Weight classification: Normal weight.

2.02 CONCRETE MASONRY UNITS (CMU)

A. Hollow and solid concrete masonry units shall conform to ASTMC90. Cement shall have a low alkali content and be of one brand.

1. Aggregates: Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirement when tested for stain-producing iron compounds in accordance with ATM C641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2. Kinds and Shapes: Units shall be modular in size and shall include closer, jamb, header, lintel and bond beam units and special shapes and sizers to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1-inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar – ASTM C270, Type S using either ASTM C1329, Type S mortar cement or ASTM C91, Type S masonry cement. Other mortar materials shall meet the requirements of the ASTM standards listed in ASTM C270.

B. Grout – ASTM C 476, 3,000 psi at 28 days with high w/c ratio and minimum slump of 8-10". Do not use water reducers to obtain slump in grout.

C. Portland cement: ASTMC150, Type 1 or II. Provide natural color.

D. Ready-mixed mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set controlling admixtures to produce a ready-mixed mortar complying with ASTM C1142.

E. Hydrated lime: ASTMC207, Type S.

F. Aggregate for mortar: ASTM C144, except for joints less than ¼ inch use aggregate graded with 100 percent passing the #16 sieve.

G. Aggregate for grout: ASTMC404.

H. Water: Clean and potable.

2.04 REINFORCING STEEL

A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article, formed from the following:

1. Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.

2. Reinforcing bars ASTM A615 Grade 60 deformed.

B. Description: Galvanized welded wire units pre-fabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with pre-fabricated corner on tee units, and complying with requirements indicated below:

1. Wire diameter for side rods: 0.1483 inch (9 gage).

C. For single wythe masonry, provide type as follows with single pair of side rods:
   1. Ladder design with perpendicular cross rods only spaced not more than 16 inches O.C.

D. For multi-wythe masonry, provide type as follows:
   1. Ladder design with perpendicular cross spaced not more than 16 inches O.C. and number of side rods as follows:
   2. Number of side rods for multi-wythe concrete masonry: One side rod for each face shell of hollow masonry units more than 4 inches or less in nominal width.

E. Tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches O.C., with side rods spaced for embedment within each face shell of back-up wythe and ties extended to engage the outer wythe by at least 1 ½ inches.

F. Use units with adjustable two-piece rectangular ties where horizontal joints of facing wythe do not align with those of back-up by more than and where indicated.

G. Available manufacturers: Subject to compliance with requirements, manufacturers offering joint reinforcement that may be incorporated in the Work include, but are not limited to, the following:
   1. AA Wire Products
   2. Dur-O-Wal, Inc.
   3. Heckman Building Products, Inc.
   4. Hohmann & Barnard, Inc.
   5. Wire-Bond

2.05 TIES AND ANCHORS

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of reference unit masonry standard and this article.

B. Galvanized carbon steel wire: ASTMA82, coating class as required by reference unit masonry standard for application indicated.

C. Wire diameter: 0.1875 inch.

D. Galvanized heavy thickness steel sheet: ASTMA635 (commercial quality) hot-rolled carbon steel sheet hot-dip galvanized after fabrication to comply with ASTMA525, Class B3, for rigid anchors fabricated from steel sheet or strip with a thickness of 0.180 inch and greater.

E. Steel plates and bars: ASTMA36, hot dipped galvanized to comply with ASTMA123 or ASTMA153, Class B3, as applicable to size and form indicated.

F. 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:
   1. Dur-O-Wal, Inc.
   2. Heckman Building Products, Inc.
   3. Hohmann & Barnard, Inc.

2.06 BENT WIRE TIES

A. Individual units pre-fabricated from bent wire to comply with requirements indicated below:

1. Tie shape for hollow masonry units laid with cells vertical: Rectangular with closed ends and not less than four (4) inches wide.

B. Type for masonry where coursing between wythes align: Unit ties bent from one piece of wire.

C. Type for masonry where coursing between wythes does not align: Adjustable ties composed of two parts, one with pintles, the other with eyes, maximum misalignment: 1-1/4 inches.

2.07 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL WORK

A. General: Two piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression force perpendicular to it.

B. For anchorage to concrete framework, provide manufacturer's standard with dovetail anchor section formed from sheet metal and triangular shaped wire ties section sized to extend within one (1) inch of masonry face and as follows:

1. Wire diameter: 0.1875 inch.

2.08 MISCELLANEOUS ANCHORS

A. Unit type masonry inserts in concrete: Cast iron or malleable iron inserts of type and sized indicated.

B. Dovetail slots: Furnished dovetail slots, with filler strips, or slot size indicated, fabricated from 0.0336 inch (22 gauge) sheet metal.

C. Rebar Positioners: Furnish 9 gauge, galvanized rebar positioners with one bent wire in each face shell and double closed loops to accurately position rebar.

2.09 POST-INSTALLED ANCHORS

A. Anchors as described below, with capacity to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTME488, conducted by a qualified independent testing laboratory.

1. Type: Chemical Anchors
2. Type: Expansion Anchors

B. Corrosion protection: Carbon steel components zinc plated to comply with ASTMB633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

C. For cast-in-place and post-installed anchors in concrete: Capability to sustain, without failure, a load equal to four (4) times load imposed.

D. For post-installed anchors in grouted concrete masonry units: Capability to sustain, without failure, a load equal to six (6) times loads imposed.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Non-metallic expansion joint strips: Pre-molded filler strips complying with ASTMD1056, type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression deflection range of 2 – 5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from the following material:

1. Neoprene
2. Urethane
3. Polyvinyl chloride

B. Pre-formed control joint gaskets: Materials as indicted below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicted:

1. Styrene-Butadiene rubber compound: ASTMD2000, Designation 2AA-805
2. Polyvinyl Chloride: ASTMD2287, General Purpose Grade, Type PVC-65406

C. Bond breaker strips: Asphalt saturated organic roofing felt complying with ASTMD226, Type 1 (No. 15 asphalt felt).

2.11 MASONRY CLEANERS

A. Job mixed detergent solution: Solution of trisodium phosphate (1/2 cup dry measure) dissolved in one gallon of water.

B. Job mixed muriatic solution: Solution of 1 part muriatic acid and ten (10) parts clean water, mixed in a non-metallic container with acid added to water.

C. Proprietary acidic cleaner: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

D. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface acting acids, cheating, and wetting agents.

E. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.

F. Available products: Subject to compliance with requirements, a product that may be used to clean until masonry surfaces includes, but is not limited to, the following:

1. "Sure Klean No. 600 Detergent", ProSoCo, Inc.
2. "Sure Klean No. 101 Lime Solvent", ProSoCo, Inc.
3. "Sure Klean Vana Trol", ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, antifreeze compounds, or admixtures, unless otherwise indicated.

B. Do not use calcium chloride in mortar or grout.

C. Mortar for unit masonry: Comply with ASTMC270, Proportion Specification, for types of mortar indicated below:

1. Type M or S, Portland Cement/Lime or Mortar cement mortar only. Do not use Masonry cement mortar for concrete masonry.

D. Grout for unit masonry: Comply with ASTMC476 and referenced unit masonry standard. Use concrete grout with pea gravel for all grouting in 8″ and larger concrete masonry units.

2.13 SOURCE QUALITY CONTROL

A. Concrete masonry unit tests: For each type, class, and grade of concrete masonry unit indicated, units will be tested by qualified independent testing laboratory for strength, absorption, and moisture content per ASTMC140, if required by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION - GENERAL

A. Mix mortar and grout in power driven, drum type mixers. Operate mixer a minimum of five (5) minutes after addition of all materials.

B. Comply with referenced unit masonry standard and other masonry construction to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as shown or required to accommodate items specified in this and other sections of the specifications. Provide not less than eight (8) inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

E. Cut masonry units with motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining constructions. Uses full size units without cutting where possible.

F. Matching existing masonry: Where applicable, match coursing, bonding, color, and texture of new masonry with existing masonry.

3.03 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of NCMA.

3.04 LAYING MASONRY WALLS

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond pattern for exposed masonry: Lay exposed masonry in the following bond pattern; Do not use units with less than nominal four (4) inch horizontal face dimensions at corners or jambs.

1. One half running bond with vertical joint in each course centered on units in courses above and below.

D. Lay concealed masonry with all units in a wythe in running bond or bounded by lapping not less than two (2) inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal four (4) inch horizontal face dimensions at corners or jambs.

E. Stopping and resuming work: In each course, rack back ½ unit length for one-half running bond or 1/3 unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

F. Re-temper mortar as necessary to keep plastic. Use no mortar after setting has begun or after 2 ½ hours of initial mixing.

G. Built-in work: As construction progresses, built-in items specified under this and other sections of the specifications. Fill in solidly with masonry around built-in items.

H. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

I. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

J. Fill cores in hollow concrete masonry units with grout three (3) courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

K. Reinforced vertical concrete blocks cells, grouting solid where indicated on plan.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows: With full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

3.06 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch of exterior side of walls, ½ inch elsewhere. Lap reinforcing a minimum of six (6) inches.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by use of pre-fabricated "L" and "T" sections. Cut and bed reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

D. Provide horizontal joint reinforcement at doors and windows for first and second block course above and below apertures. Run reinforcing continuous or extend two (2) feet from aperture edge.

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 one (1) inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches O.C. vertically and 26 inches O.C. horizontally.

3.08 MOVEMENT (CONTROL AND EXPANSION) JOINTS

A. General: Install control and expansion joints in unit masonry where indicated, not to exceed twenty five feet on centers (25'-0"). Build in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond breaker strips on in ends of block units on one side of control joint. Fill the joint with mortar and rake joints in exposed faces.

3.09 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 1'- 0" for brick size units and 2' – 0" for block size units are shown without structural steel or other supporting lintels. Provide reinforced pre-cast concrete lintels. Cure pre-cast lintels before handling and installation.

C. Provide minimum bearing of eight (8) inches at each jamb, unless otherwise indicated.

3.10 INSTALLATION OF REINFORCED UNIT MASONRY

A. General: Install reinforced unit masonry to comply with requirements or referenced unit masonry standard. All reinforced unit masonry shall be inspected by a certified structural masonry inspector.

B. Temporary formwork: Construct formwork and shores to support reinforced masonry elements during construction. Contractor is completely responsible for the proper design and construction of all temporary forms and bracing.

C. Construct formwork to conform to shape, line, and dimensions shown. Make 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.

D. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

E. All vertical reinforcing in concrete masonry cells shall be held in place with rebar positioners. At least one positioner shall be used at the top and bottom of each grout pour.

F. 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.

G. Masonry wall lateral support interval, per Florida Building Code Table 2109.4.1, is 12 foot horizontal maximum.

H. High-lift grouting in conformance with TMS 402/602 shall be used for all reinforced masonry. Maximum grout pour height shall be 12'-0", placed in 6'-0" maximum lifts.

3.11 STRUCTURAL BONDING OF MULTIWYTHE MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown, but not less than 1 metal tie for 4 sq. ft. (0.37 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

B. Use continuous horizontal-joint reinforcement installed in horizontal mortar joints for bond tie between wythes.

C. Use either of the structural bonding systems specified above.

D. Use structural bonding system indicated on Drawings.

E. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. Provide continuity with horizontal-joint reinforcement at corners by using prefabricated "L" units in addition to masonry bonding.

F. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
1. Provide continuity with horizontal-joint reinforcement by using prefabricated "T" units.
2. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.12 FLASHING, WEEP HOLES, AND VENTS

G. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

H. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.

I. Install flashing as follows:
3. At composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches (100 mm), and through the inner wythe to within 1/2 inch (13 mm) of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches (50 mm), unless otherwise indicated.
4. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn up not less than 2 inches (50 mm) to form a pan.
3. Interlock end joints of ribbed sheet-metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements of Division 7 Section "Joint Sealants" for application indicated.
4. Extend sheet-metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn down to form a drip.
5. Cut off flashing flush with face of wall after masonry wall construction is completed.

J. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
1. Form weep holes with product specified in Part 2 of this Section.
2. Form weep holes by keeping head joints free and clear of mortar.
3. Space weep holes 24 inches (600 mm) o.c.
4. Space weep holes 16 inches (400 mm) o.c.
5. In cavities, place pea gravel to a height equal to height of first course, but not less than 2 inches (50 mm), immediately above top of flashing embedded in the wall, as masonry construction progresses, to splatter mortar droppings and to maintain drainage.
6. Place cavity drainage material immediately above flashing in cavities.
7. In insulated cavities, cover cavity side of open weep holes with copper or plastic insect screening before placing loose-fill masonry insulation in cavity.

K. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

L. Install vents in vertical head joints at the top of each continuous cavity. Space vents and close off cavities vertically and horizontally with blocking in manner indicated.
   1. Install through-wall flashing and weep holes above horizontal blocking.

M. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

3.13 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
   1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
   2. Provide temporary opening by omitting 1 brick every 48 inches (1200 mm) at bottom of cavity and in first course above flashing. After wall has been built to top of cavity and mortar has set, flush out cavity with a hose, allow to dry, and then close temporary opening.

B. Tie exterior wythe to back-up with continuous horizontal-joint reinforcing

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. 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 non-metallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave ½ 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, polyethylene film, or waterproof masking tape.
   4. Wet all surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of substantial completion.

END OF SECTION

SECTION 04225
MASONRY MORTAR, CMU

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide mortar for load bearing concrete masonry unit (CMU) work indicated and specified.

1.02 QUALITY ASSURANCE

A. Mortar for load bearing CMU walls shall conform to the following standards:
   1. The Masonry Society TMS 402/602.
   2. ASTM Specifications referenced herein.
   3. National Concrete Masonry Association (NCMA): TEK notes information series.

B. Testing and Inspection of Mortar for Load Bearing CMU Walls:
   1. Contractor shall employ and pay for the services of an independent testing laboratory for preparation and testing of mortar cubes for each type mortar specified for compliance with requirements of referenced mortar standards.
   2. For additional testing and inspection requirements, refer to Section CONCRETE MASONRY UNITS/LIGHTWEIGHT.

C. Use only one source brand of mortar materials.

1.03 SUBMITTALS

A. Product Data: Submit for each mortar material.

1.04 MATERIAL STORAGE

A. Store mortar materials off ground in waterproof shelter.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150:
   1. Type I natural gray color.
   2. Type III high-early-strength; use for laying masonry in cold weather.

B. Masonry Cement: ASTM C91, except with 12% maximum air content by volume non-staining type.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates: ASTM C144, sharp, natural sand.

E. Water: Drinkable

2.02 MORTAR FOR UNIT MASONRY

A. Do not lower the freezing point or mortar by use of admixtures or anti-freeze agents.

B. Do not use calcium chloride in mortar.

2.03 MORTAR TYPE AND PROPORTION

A. Mortar for all masonry not otherwise indicated shall conform to ASTM C270, Type S Mortar, 3,250 psi at 28 days. Proportions shall be by volume. Aggregate shall be damp, loose sand measure. Provide one of the following:

1. Masonry Cement Mortar:
   a. Portland Cement: ½ part.
   b. Masonry Cement: One part.
   c. Aggregate: Not less than 3-1/2 and not more than 4-1/2 parts.
2. Cement-Lime Mortar:
   a. Portland Cement: One part.
   b. Lime: ¼ to ½ part/
   c. Aggregate: Not less than 3 and not more than 4 parts.

2.04 GROUT

A. Grout for filling masonry cells, cavities and lintels shall be 3,000 psi concrete in accordance with requirements specified in Section, CAST-IN-PLACE CONCRETE in Division 3. Conform to ASTM C476.

PART 3 - EXECUTION

3.01 MEASURING

A. Do not use shovels for measuring mortar materials.

B. Use a measuring container of a calculated volume in cubic feet of the cement and masonry cement to place all materials in mixer.

3.02 MIXING

A. Thoroughly machine mix for a period of not less than 3 minutes and not more than 5 minutes after all materials are in the mixer.

3.03 APPLICATION

A. Use and place mortar in final position within 2-1/2 hours after mixing. Discard all mortar not used within this limit.

B. Mortars that have stiffened within 2-1/2 hours after mixing because of evaporation of moisture from mortar may be retempered to restore workability by adding water as frequently as needed to restore the required consistency.

3.04 QUALITY CONTROL

A. Contractor shall employ and pay an independent testing laboratory to provide quality control procedures for all masonry mortar in accordance with ASTM C780.

END OF SECTION

SECTION 07211
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
   a. Extruded-Polystyrene Board Insulation
   b. Un-faced Wall Insulation
2. Glass-fiber blanket insulation.
3. Vapor retarders.

B. Related Sections:

1. Division 07 Section(s) for insulation specified as part of roofing construction.
2. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire- resistive joint system.
3. Division 09 Section(s) "Gypsum Board Shaft Wall Assemblies" for installation in wood- and metal-framed assemblies of insulation specified by referencing this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 QUALITY ASSURANCE

A. 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.

B. In no case shall added insulation values be less than the prescriptive requirements listed in the current Energy Code published in the state where the work will be installed.

C. Minimum R-Value Requirements

1. Steep Roofs: R-38 inside the vented truss space with R-19 between bottom-chord and R-19 perpendicular and continuous across the first layer and the bottom-chord.
2. Low Slope Roofs: Above the roof deck; R-20 continuous rigid insulation.
3. Exterior Metal Studs: R19 with R-7.5 continuous on exterior of studs, R-13 between metal studs with craft face behind exterior sheathing and facing in an outward direction.

4. Exterior CMU: R-7.5 continuous rigid Extruded Polystyrene (XPS) 2.0 lbs density on interior of block. Insulation to be un-faced and within type X GWB assembly.
5. Exterior EIFS on CMU: R-7.5 continuous rigid Extruded Polystyrene (XPS) 2.0 lbs density on exterior of block with drainage plane at block exterior face.
6. Exterior EIFS on Metal Studs: R19 with R-7.5 continuous on exterior of studs, R-13 between metal studs with craft face behind exterior sheathing and facing in an outward direction.
7. Interior Walls: R-11
8. Common Party Walls: R-11 Stud; R-6 CMU
9. Bathroom / Restroom Ceilings: R-11

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. For walls on exterior face in EIF Systems: Extruded-Polystyrene Board Insulation: ASTM C 578, of type IV, density 1.6 lb/cu. ft. density minimum, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. For walls on exterior face: Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class I, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

C. For CMU walls on interior face: Un-faced Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class I, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
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. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Owens Corning
d. Rmax, Inc.
e. Elliott Company Inc.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corporation.
   2. Guardian Building Products, Inc.
   3. Johns Manville.
   4. Knauf Insulation.
   5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke- developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 VAPOR RETARDERS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Single-Component Non-sag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic space s and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation 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. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION LOCATION

A. Locations:

1. Provide un-faced blanket insulation in interior partition unless otherwise noted below.
2. Provide faced kraft, blanket insulation in exterior walls and ceiling areas unless otherwise noted below.

B. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt form with thermal resistances indicated.

1. 3 inch thick with a thermal resistance of 11 deg F x h x sq.ft./ Btu at 75 deg F.
2. 3-1/2 inches thick with a thermal resistance of 13 deg F x h x sq.ft./ Btu at 75 deg F.
3. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq.ft./ Btu at 75 deg F.
4. 6-1/2 inches thick with a thermal resistance of 21 deg F x h x sq.ft./ Btu at 75 deg F.
5. 9-1/2 inches thick with a thermal resistance of 30 deg F x h x sq.ft./ Btu at 75 deg F.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool 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 to specified thickness in wall. 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.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support un-faced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
   a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
   b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
   a. Exterior Walls: Set units with facing placed toward exterior of construction.
   b. Interior Walls: Set units with facing placed toward areas of high humidity.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions. Continue vapor barrier and seal to top of wall and bottom of roof deck where steep roof and low slope roofing systems intersect.

3.6 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 07250
WEATHER RESISTANT BARRIERS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Weather barrier membrane: Commercial Wrap

B. Seam Tape

C. Flashing and Thru-Wall Flashing

D. Fasteners

1.2 REFERENCES

A. ASTM International
1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
2. ASTM C1193; Standard Guide for Use of Joint Sealants
3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E96; Test Method for Water Vapor Transmission of Materials
7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
8. ASTM E2178; Test Method for Air Permeance of Building Materials
9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Association of Textile Chemists and Colorists
1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI
1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.3 SUBMITTALS

A. Refer to Section 01300 Submittal Procedures

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals
1. Refer to Section [01 78 00 Closeout Submittals] [insert section number and title].

2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications
   1. Installer shall have experience with installation of commercial weather barrier assemblies under similar conditions.
   2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
   3. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.

B. Mock-up
   1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
      a. Mock-up size: [10 feet by 10 feet] [insert size].
      b. Mock-up Substrate: Match wall assembly construction, including window opening.
      c. Mock-up may [not] remain as part of the work.
   2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting
   1. Refer to Section [01 31 19 Project Meetings] [insert section number and title].
   2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
   3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section [01 60 00 Product Requirements] [insert section number and title].

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.6 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.7 WARRANTY

A. Refer to Section 01740 Warranties & Bonds

B. Special Warranty

1. Special weather-barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of purchase.
2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty are required.
3. Warranty Areas: [Describe specific areas of work protected and areas of work excluded as required by project conditions].

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. DuPont; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1-800-44-TYVEK (8-9835); http://www.construction.tyvek.com

2.2 MATERIALS

A. Basis of Design: spun-bonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont Tyvek Commercial Wrap and related assembly components.

B. Performance Characteristics:

1. Air Penetration: 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357
2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

2.3 ACCESSORIES

A. Seam Tape: 3-inch-wide, DuPont™ Tyvek® Tape for commercial applications.

B. Fasteners:

1. Masonry tap-con fasteners with Tyvek® Wrap Caps as distributed by DuPont: 2-inch diameter plastic cap fasteners.

C. Sealants

1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.

D. Products:
1. Commercial Sealant
2. Residential Sealant
3. Sealants recommended by the weather barrier manufacturer.

E. Adhesives:
1. Provide adhesive recommended by weather barrier manufacturer.
2. Products:
a. Liquid Nails® LN-109
b. Denso Butyl Liquid
c. 3M High Strength 90
d. SIA 655
e. Adhesives recommend by the weather barrier manufacturer.

F. Primers:
1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
2. Products:
a. 3M High Strength 90
b. Denso Butyl Spray
c. SIA 655
d. Permagrip 105
e. ITW TACC Sta' Put SPH
f. Primers recommended by the flashing manufacturer

G. Flashing
1. DuPont™ FlexWrap™, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
2. DuPont™ Thru-Wall Surface Adhered Membrane with Integrated Drip Edge: Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials.
3. Preformed Inside and Outside Corners and End Dams as distributed by DuPont: Preformed three-dimensional shapes to complete the flashing system used in conjunction with DuPont™ Thru-Wall Flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION – WEATHER BARRIER

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier
   1. Exterior corners: minimum 12 inches.
   2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:
   1. Attach weather barrier to masonry. Secure using weather barrier manufacturer recommended fasteners, spaced 12-18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.

I. Apply 4 inch by 7 inch piece of DuPont™ StraightFlash™ or weather barrier manufacturer approved alternate to weather barrier membrane prior to the installation cladding anchors.

3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION (for use with non-flanged windows – all cladding types)

A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 FLASHING (for use with non-flanged windows – all cladding types)

A. Cut [7-inch] [9-inch] wide DuPont™ FlexWrap™ or DuPont™ FlexWrap™ NF a minimum of 12 inches longer than width of sill rough opening. Apply primer as required by manufacturer.

B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges. Mechanical fastening is not required for DuPont™ FlexWrap™ NF.

D. Apply 9-inch wide strips of DuPont™ StraightFlash™ at jambs. Align flashing with interior edge of jamb framing. Start DuPont™ StraightFlash™ at head of opening and lap sill flashing down

to the sill.

E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.

F. Install DuPont™ FlexWrap™ DuPont™ FlexWrap™ NF at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.

G. Coordinate flashing with window installation.

H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C 1193.

I. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.

J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.6 OPENING PREPARATION (for use with flanged windows)

A. Cut weather barrier in an "I-cut" pattern. A modified I-cut is also acceptable.
   1. Cut weather barrier horizontally along the bottom and top of the window opening.
   2. From the top center of the window opening, cut weather barrier vertically down to the sill.
   3. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.7 FLASHING (for use with flanged windows)

A. Cut [7-inch] [9-inch] wide DuPont™ FlexWrap™ or DuPont™ FlexWrap™ NF a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges. Mechanical fastening is not required for DuPont™ FlexWrap™ NF.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer's instructions.

F. Apply 4-inch wide strips of DuPont™ StraightFlash™ at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply 4-inch wide strip of DuPont™ StraightFlash™ as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations.

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.8 THRU-WALL FLASHING INSTALLATION

A. Apply primer per manufacturer's written instructions.

B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.

E. Roll flashing into place. Ensure continuous and direct contact with substrate.

F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.

G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions.

H. Terminate membrane on vertical wall. [Terminate into reglet, counterflashing or with termination bar.]

I. Apply sealant bead at each termination.

3.9 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT WINDOW HEAD

A. Cut flap in weather barrier at window head.

B. Prime exposed sheathing.

C. Install lintel as required. Verify end dams extend 4 inches minimum beyond opening.

D. Install end dams bedded in sealant.

E. Adhere 2 inches minimum thru-wall flashing to wall sheathing. Overlap lintel with thru-wall flashing and extend ¼ inch minimum beyond outside edge of lintel to form drip edge.

F. Apply sealant along thru-wall flashing edges.

G. Fold weather barrier flap back into place and tape bottom edge to thru-wall flashing.

H. Tape diagonal cuts of weather barrier.

I. Secure weather barrier flap with fasteners.

3.10 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain [required] periodic observations of weather barrier assembly installation.

3.11 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION

SECTION 07311
FIBERGLASS SHINGLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. Fiberglass shingle roofing, with moisture shedding underlayment, eave, valley, and ridge protection and associated protective flashings.

1.03 RELATED WORK

A. Section 06001 – Rough Carpentry

B. Section 07710 – Prefabricated Roofing Specialties

1.04 REFERENCES

A. ANSI/ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

B. ANSI/ASTM D225 – Asphalt Shingles Surfaced with Mineral Granules.

C. ANSI/ASTM D226 – Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

D. ANSI/ASTM D249 – Asphalt Roll Roofing Surfaced with Mineral Granules.

E. ANSI/ASTM D2822 – Asphalt Roof Cement.

F. ANSI/ASTM D3018 – Class A Asphalt Shingles Surfaced with Mineral Granules.

G. ASTM A361 – Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding.

H. ASTM B370 – Copper Sheet and Strip for Building Construction.

I. FS L-P-375 – Plastic Film, Flexible, Vinyl Chloride.

J. NRCA-1989 – Roofing and Waterproofing Manual.

1.04 SUBMITTALS

A. Indicate general construction, configurations, jointing methods and locations, fastening methods and locations, and installation details.

B. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE DIMENSIONAL FIBERGLASS SHINGLES MANUFACTURERS

A. Certainteed

B. Georgia Pacific

C. GAF Building Corporation

2.02 ROOFING MATERIALS

A. Fiberglass Shingles: Lifetime warranty, Dimensional Shingles, organic felt base, mineral granule surfaced type; 210 lb/square; self-sealing type; square tab; color selected by Architect.

B. Underlayment: Fiber building paper, water repellent type. No. 15 (73 kg/sq m) unperforated asphalt saturated felts as recommended for use in waterproofing and in construction of built-up roofs.

C. Nails: Standard round wire shingle type of hot-dipped zinc-coated steel; minimum 13/64 inch (5 mm) head diameter and 0.080 inch (2 mm) shank diameter; minimum 1-1/4 inch (31 mm) long.

D. Plastic Cement: Cutback asphaltic type with mineral fiber components as recommended for sealing and coating flashings in buildings; free of toxic solvents; capable of setting within 24 hours at temperatures of approximately 75

E. Lap Cement

2.03 FLASHING MATERIALS

A. Sheet Flashings: ASTM A361; 26 gage thick steel with minimum 1.25 oz/sq ft. galvanized coating.

B. Bitumous Paint: Acid and alkali resistant type; black color.

C. Nails: Standard round wire roofing type of hot-dipped zinc-coated steel; minimum 19/64 inch (8 mm) head diameter and 0.104 inch (3 mm) shank diameter; minimum 7/8 inch (22.2 mm) long.

2.04 FLASHING FABRICATION

A. Form flashings to profiles indicated on Drawings, and to protect roof assembly and shed water. Form sections square, true, and accurate to profile, in maximum possible lengths, free from distortion and other defects detrimental to appearance or performance.

B. Hem exposed edges of flashings minimum ¼ inch on underside.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Install asphalt shingle roofing over dry surfaces, free of ridges, warps, and voids.

B. Coordinate installation of roof mounted components or work projecting through roof. Verify roof openings are framed, sized, and located prior to installing work of this Section.

C. Completed installation to provide weathertight service.

3.02 EAVE PROTECTION INSTALLATION

A. Place eave edge and gable flashing tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure deck flange per manufacturer's instructions.

B. Apply 4 inch (100 mm) wide band of plastic cement over deck flange of eave edge flashings, and embed an 18 inch wide strip of underlayment. Place underlayment with eave edge flush with face of flashings. Secure in place. Lap ends minimum 6 inches. .

C. Apply lap cement at rate of approximately 1-1/4 gal/square on underlayment starter strip.

D. Starting from eave edge of starter strip, lay additional 36 inch (900 mm) wide strips of underlayment in lap cement, to produce a two ply membrane. Weather lap plies minimum 19 inches and nail in place. Lap ends minimum 6 inches. Stagger end joints of each consecutive ply.

E. Extend eave protection membrane minimum 2 feet beyond interior face of walls.

END OF SECTION

SECTION 07620
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. Roof curb, roof penetrations, exterior doors and exterior window flashings.

B. Work of this Section is to physically protect membrane roofing, base flashings, and their connections from damage that would permit water leakage to building interior.

1.03 RELATED WORK

A. Section 04200 Unit Masonry.

B. Section 06001 Wood blocking, nailers, and grounds.

C. Section 07900 Joint Sealers

D. Section 08111 Hollow Metal Doors and Frames

E. Section 08520 Aluminum Windows

F. Section 09220 Portland Cement Stucco.

G. Section 09900 Painting: Prime and finish painting.

1.04 REFERENCES

A. AA (Aluminum Association) – Aluminum Construction Manual: Aluminum Sheet Metal Work and Building Construction.

B. ANSI/ASTM B 32 – Solder Metal

C. ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate.

D. ASTM D 226 – Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

E. NRCA (National Roofing Contractors Association) – Roofing Manual.

F. SMACNA – Architectural Sheet Metal Manual

1.05 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with three years minimum experience.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300.

B. Describe material profile, jointing pattern, details, fastening methods, and installation details.

1.07 STORAGE AND HANDLING

A. Store products under provisions of Section 01600.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining or damage.

PART 2 - GENERAL

2.01 PRODUCTS

A. Aluminum Sheet: ASTM B 209, 24 gauge shop pre-coated with coating of selected color as selected by Architect.

2.02 ACCESSORIES

A. Fastener: Galvanized steel or cadmium plating soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

B. Underlayment: ASTM D 266; No. 90 asphalt saturated roofing felt.

C. Sealant: Type specified in Section 07900.

D. Plastic cement: FS SS-C-153, Type 1- Asphaltic base cement.

E. Reglets: Surface mounted .032 inch mill finish aluminum models RC-1 and RC-2; manufactured by M-M Systems; face and ends covered with plastic tape.

F. Solder: ANSI/ASTM B 32; 60/40 or 80/20 type.

G. Flux: FS O-F-506

2.03 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with 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. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

D. 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.

E. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

F. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

G. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

1. Material: Stainless steel, 0.0187 inch (0.5 mm) thick.
2. Material: Aluminum, 0.024 inch (0.6 mm) thick.
3. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.

H. 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.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square and free from distortion or defects.

B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.

C. Form pieces in longest practical lengths.

D. Hem exposed edges on underside ½" (13mm); miter and seam corners.

E. Form material with standing flat lock cover plate seam.

F. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

G. Fabricate corners from one piece with minimum 18 inch long legs; seam solder for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward ¼" (6mm) and hemmed to form drip.

I. Fabricate flashings to allow toe to extend two inches over roofing. Return and brake edges.

2.05 FINISH

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations on applying and designation finishes.

B. Fluoropolymer two-coat coating system: Manufacturer's standard two-coat thermocured system complying with AAMA 605.2, composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene resin by weight, complying with AAMA 605.2.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

D. Insert flashings into reglets to form tight fit. Secure in place with lead plastic wedges at maximum 12 inches on center. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect/Engineer.

F. Lap and seal all joints.

G. Apply plastic cement compound between metal flashings and felt flashing.

H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

I. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

J. Seal metal joints watertight.

3.03 INSTALLATION

A. Conform to drawing details and details included in SMACNA and NRCA manual.

3.04 SCHEDULE

A. Flashing at exterior doors and windows.

B. Flashing at roof curb openings and other roof and wall penetrations.

END OF SECTION

SECTION 09256
TILING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Ceramic floor and wall tile.

B. Related Sections:
   1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 09 Section "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Dynamic Static Coefficient of Friction (DCOF): For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per DCOF Acutest; and as indicated by current code local ordinances and authorities having jurisdiction, whichever is most stringent.
   1. Dry & Level – Interior: N/A
   2. Wet & Level – Interior: >0.42
   3. Exterior Applications, Pool Decking & Other Wet Areas w/ Minimal Footwear: >0.60
   4. Ramps & Inclines: >0.65

1.5 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. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Stone thresholds in 6-inch lengths.
   5. Metal edge strips in 6-inch lengths.

D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 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.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated**.**
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Refer to interior design documents for selection of tiles and accessories.

2.3 SETTING MATERIALS

A. 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. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo, Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Mer-Kote Products, Inc.
j. Southern Grouts & Mortars, Inc.
k. Summitville Titles, Inc.
l. 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.

B. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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. Atlas Minerals & Chemicals, Inc.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Mer-Kote Products, Inc.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC; a subsidiary of H. B. Fuller Company.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

2.4 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

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. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.

e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "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).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

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. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Corning Corporation; Dow Corning 786.
   b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
   c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
   d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
   e. Tremco Incorporated; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.7 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile- setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and

packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile swimming pool decks.
   d. Tile floors in laundries.
   e. Tile floors composed of tiles 8 by 8 inches or larger.
   f. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. 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.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Quarry Tile: 1/4 inch.
3. Paver Tile: 1/4 inch
4. Glazed Wall Tile: 1/16 inch.

5. Decorative Thin Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
2. Do not extend or crack isolation membrane under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 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 epoxy and latex-portland cement 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 and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
   a. Thin-Set Mortar: Latex portland cement mortar.
   b. Grout: Standard sanded cement grout.

2. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCA W245.
   a. Thin-Set Mortar: Latex-portland cement mortar.
   b. Grout: Standard sanded cement grout.

END OF SECTION

SECTION 09912
INTERIOR PAINTS AND COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A Interior paint and coatings systems including: paint, stains, transparent coatings, and opaque finishes

1.2 RELATED SECTIONS

A Division 1 - General Data

B Division 3 - Concrete

C Division 4 - Metal, Primer and Coatings

D Division 6 - Architectural Wood and Plaster Coating

E Division 8 – Doors and Windows

1.3 REFERENCES

A SSPC-SP 1 - Solvent Cleaning

B SSPC-SP 2 - Hand Tool Cleaning

C SSPC-SP 3 - Power Tool Cleaning

D SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete

1.4 SUBMITTALS

A Submit under provisions of Section 01300 Submittals

B Product Data: Manufacturer's data sheets on each paint and coating product should include:

1 Product characteristics
2 Surface preparation instructions and recommendations
3 Primer requirements and finish specification
4 Storage and handling requirements and recommendations
5 Application methods
6 Cleanup Information

C Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer’s color samples available.

D Coating Maintenance Manual: upon conclusion of the project, the Contractor or paint manufacture/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MOCK-UP

Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of painting on the project.

A Finish surfaces for verification of products, colors, & sheens

B Finish area designated by Architect

C Provide samples that designate prime & finish coats

D Do not proceed with remaining work until the Architect approves the mock-up samples

1.6 DELIVERY, STORAGE, AND HANDLING

A Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacture's name, label, and the following list of information:

Product name and type (description)
Application & use instructions
Surface preparation
VOC content
Environmental handling
Batch date
Color number

B Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

C Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Preferred Manufacturer:
1. Sherwin Williams: www.sherwin-williams.com
2. Benjamin Moore & Co: www.benjaminmoore.com
3. PPG Paint: www.ppg.com
4. MDC: www.mdcwall.com

B Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01600 Product Requirements. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.2 APPLICATION/SCOPE

A Use this article to define the scope of painting if not fully defined in a Finish Schedule or on the drawings. This article must be carefully edited to reflect the surfaces actually found on the project. In some cases, it may be enough to use the first paragraph that says, in effect, "paint everything" along with a list of items not to paint, without exhaustively defining all the different surfaces and items that must be painted.

B If the project involves repainting some but not all existing painted surfaces, be sure to indicate the extent of the repainting.

C The descriptions of each system can also be used to further refine the definition of what is to be painted, stained, or clear finished.

D Surfaces to Be Coated:
Concrete: Poured, Precast, Tilt-Up, Cast-In-Place, Cement Board, Plaster
Concrete: Floors
Masonry: (CMU - Concrete, Split Face, Scored, Smooth, etc.)
Metal: Aluminum/ Galvanizing
Metal Ferrous: (Structural Steel, Joists, Trusses, Beams, Partitions, etc.)
Wood: Walls, Ceilings, Doors, Trim, etc
Wood: Floors-Painted
Drywall: Drywall board, Gypsum board

2.3 SCHEDULE

A. WOOD- (Walls, Ceilings, Doors, Trim, Partitions, Frames)

1. Latex Systems

a. Semi-Gloss Finish

1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series
3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series (4 mils wet, 1.3 mils dry per coat)

2. Stain, Sealer & Varnish

a. Clear Finish

1st Coat: S-W Wood Classics 250 Oil Stain, A49-800 Series Or S-W Wood Classics Interior Oil Stain, A49 Series
2nd Coat: S-W Wood Classics FastDry Sanding Sealer, B26V43
3rd Coat: S-W Wood Classics FastDry Varnish, Gloss or Satin, A66 Series (4 mils wet, 1.3 mils dry per coat)

B. DRYWALL (Walls, Ceilings, Gypsum Board, Plaster Board, etc.)

1. Latex Systems

a. Egg-Shell Finish

1st Coat: S-W Harmony Interior Latex Primer, B11 Series (4 mils wet, 1.3 mils dry per coat)
2nd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
3rd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series (4 mils wet, 1.7 mils dry per coat)

Alternate:

1st Coat: S-W ProMar 200 Zero VOC Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry)

2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat)

C. Interior Precast Concrete Ceilings
1. Decorative spray knock-down texture.
2. Key joints shall be infilled flush with covercoat.
3. Compound by United States Gypsum Company.
4. Fill deep voids or offsets with sheet rock brand durabond joint compound.

2.4 MATERIALS - GENERAL REQUIREMENTS

A Paints and Coatings - General:
1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B Primers:
1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.5 ACCESSORIES

A Coating Application Accessories:
1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer’s specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A Do not begin application of coatings until substrates have been properly examined and prepared. Notify Architect of unsatisfactory conditions before proceeding.

B If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

D Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumesthat contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup.

For more information, call the National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority. Removal must be done in accordance with EPA Renovation, Repair and Painting Rule and all related state and local regulations. Care should be taken to follow all state and local regulations which may be more strict than those set under the federal RRP Rule.

A Proper product selection, surface preparation and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

B Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.

C The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

D Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry a minimum of 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

E Methods

1 Aluminum
Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

2 Block (Cinder and Concrete)
Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F.The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

3 Concrete, SSPC-SP13 or NACE 6
This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

4 Cement Composition Siding/Panels
Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5 Drywall—Interior
Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

6 Galvanized Metal
Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

7 Plaster
Must be allowed to dry thoroughly for at least 30 days before painting, unless the products are designed to be used in high pH environments. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1 pint household vinegar to 1 gallon of water. Repeat until the surface is hard, rinse with clear water and allow to dry.

8 Steel: Structural, Plate, etc.

Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.

9 Solvent Cleaning, SSPC-SP1
Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.

10 Hand Tool Cleaning, SSPC-SP2
Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

11 Power Tool Cleaning, SSPC-SP3
Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

12 White Metal Blast Cleaning, SSPC-SP5 or NACE 1
A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

13 Commercial Blast Cleaning, SSPC-SP6 or NACE 3
A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied

paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

14 Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4
A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

15 Power Tool Cleaning to Bare Metal, SSPC-SP11
Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

16 Near-White Blast Cleaning, SSPC-SP10 or NACE 2
A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

17 High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials SSPC-SP12 or NACE 5
This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.

18 Water Blasting, NACE Standard RP-01-72
Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

19 Wood
Must be clean and dry. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

3.3 INSTALLATION

A Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

B Do not apply to wet or damp surfaces.
1 Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
2 Test new concrete for moisture content.
3 Wait until wood is fully dry.

C Apply coatings using methods recommended by manufacturer.

D Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

F Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

G Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to the application of each coat.

3.4 PROTECTION

A Protect finished coatings from damage until completion of project.

B Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 10307
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Provide fire extinguishers approved, listed, and labeled by FMG.

1.05 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type - ABC, size – 10lb, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   h. Larsen's Manufacturing Company.
   i. Moon-American.
   j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
   k. Potter Roemer LLC.
   l. Pyro-Chem; Tyco Safety Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A: 60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked- enamel finish.

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. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   g. Larsen's Manufacturing Company.
   h. Potter Roemer LLC.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches or as indicated on drawings above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 11400
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. Work included in this Section:
Provide and install Owner provided equipment as scheduled on drawings and specified in this Section.

1.03 QUALITY ASSURANCE

A. For purposes of designing type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by manufacturers listed in the PRODUCTS Section. In case of equipment specified by description only, submit manufacturer's complete printed Specification for Architect's approval.

B. Underwriter's Laboratory Label:
All equipment shall meet requirements of Underwriter's Laboratory and shall bear that label.

1.04 SUBMITTALS

A. Manufacturer's Data: Submit for approval, three (3) copies of folder containing complete manufacturer's data and installation procedures for all materials to be used on work of this Section of specifications.

B. Shop Drawings: Submit for approval, by Architect, in accordance with GENERAL CONDITIONS. Shop drawings shall provide complete information regarding materials of fabrication, mechanical characteristics for energizing, capacity limits fall mechanical data required for providing service for each unit installed.

C. Operating Instructions: Submit in triplicate, for each item of equipment, complete operating instructions and maintenance requirements.

1.05 MANUFACTURERS

A. General Electric

B. Kenmore

C. Approved equal

PART 2 - PRODUCTS

2.01 SCHEDULE OF EQUIPMENT

A. All models indicated are General Electric and will be provided by Owner.

1. MICROWAVE/HOOD
   a. General Electric Model #JVM1631WB
2. REFRIGERATOR/FREEZER
   a. General Electric Model #TBX18SIBRWW with Icemaker
3. RANGE
   a. General Electric Model #JBP26WBWW
4. WASHER/DRYERS
   a. General Electric Model #WSM2700T White (stacked)
   b. General Electric Model #WCXR1070T – optional per Owner
   c. General Electric Model #DCLR333ET – optional per Owner

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish and install all items of equipment according to manufacturer's written instructions and shop drawings approved by Architect.

3.02 COORDINATION

A. Coordinate all final connection with the Plumbing and Electrical contractors.

3.03 SCHEDULE

A. Owner Provided Items

1. Refrigerators
2. Washer/Dryers
3. Range
4. Microwave
5. Range Hood

END OF SECTION

SECTION 12511
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This section includes the provision and installation of all materials, equipment and incidentals necessary and/or required for a complete installation of all horizontal louver blinds as specified herein.

1.03 RELATED SECTIONS

A. Division 6 Section for wood blocking and grounds for mounting horizontal louver blinds.

B. Division 8 Sections for window walls with horizontal louver blinds mounted on window frames.

C. Division 8 Sections for windows with horizontal louver blinds mounted on window frames.

D. Division 16 Sections for electrical service and connections for motorized blind operation.

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of horizontal louver blind specified. Include printed data on physical characteristics.

C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of horizontal louver blind indicated.

E. Samples for verification of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the Work.

1. Louver: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.
2. Valance: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.

F. Schedule of horizontal louver blinds using same room designations indicated on Drawings.

G. Maintenance data for horizontal louver blinds to include in the operation and maintenance manual specified in Division 1. Include the following:
   1. Methods for maintaining horizontal louver blinds and finishes.
   2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Test Method: NFPA 701.
   2. Rating: Pass.

B. Single-Source Responsibility: Obtain each type of horizontal louver blind from one source and by a single manufacturer.

C. Mockups: Prior to installing horizontal louver blinds, construct mockups for each form of construction and finish required 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 location and of 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.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's acceptance of mockups before start of final unit of Work.
   5. 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. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual horizontal louver blind dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Enclosure and Environmental Limitations: Do not install horizontal louver blinds until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Horizontal Louver Blinds: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount of each size installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. 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:

1. Horizontal Louver Blinds:
   a. Graber www.graberblinds.com
   b. Alta Blinds 800-669-6333
   c. Substitutions: See Section 01600 – Material and Equipment

2.02 HORIZONTAL LOUVER BLINDS

A. Louvers: Manufacturer's standard as follows:

1. Faux wood composite
2. Color: As Scheduled
3. Finish: Textured.
4. Nominal Louver Width: 2 inches (50 mm).

B. Tilt Operation: Cordless at all units.

1. Length of Tilt Control: Full length of blind.
2. Position of Tilt Control: Right side, unless otherwise indicated.
3. Tilt: Full.

C. Cord-Lock Operation: Top-locking cord lock; locks pull cord to stop blind in either fully opened or fully closed position only and is equipped with a ring pull not more than 10 inches (250 mm) long.

1. Position of Cord Lock: Right side, unless otherwise indicated.

D. Cord Equalizers: Self-aligning to maintain horizontal louver blind position.

E. Valance: Match color of louvers.

F. Mounting: As required.

G. Mounting: As indicated.

H. Colors and Patterns: As scheduled.

2.03 FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029 for each horizontal louver blind unit consisting of louvers, rails, cord locks, tilting mechanisms, tapes, and installation hardware.

B. Lifting and Tilting Mechanisms: Noncorrosive, self-lubricating materials.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed Between (Inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total, plus or minus 1/8 inch (3 mm), less than jamb to jamb dimension of opening in which each blind is installed. Length equal to

1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head to sill dimension of opening in which each blind is installed.

2. Blind Units Installed (Outside) Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

E. Hold-Down Brackets: Manufacturer's standard, as indicated.

F. Side Channels: Manufacturer's standard, as indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of horizontal louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install blinds level, plumb, and located so exterior louver edges in any position are not closer than 1 inch (25 mm) to interior face of glass lites.

Optional Mounts

1. Flush Mounted: Install blinds with louver edges flush with finish face of wall.
2. Jamb Mounted: Install headrail flush with face of opening jamb and head.
3. Head Mounted: Install headrail on face of opening head.

3.03 ADJUSTING

A. Adjust components and accessories for proper operation.

3.04 CLEANING

A. Clean blind surfaces, according to manufacturer's instructions, after installation.

B. Remove surplus materials, packaging, rubbish, and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.05 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure that horizontal louver blinds are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 15010
GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections, apply to this and the other sections of Division 15.

1.02 SUMMARY

A. Section includes:
1. General administrative and procedural requirements, as well as basic mechanical materials and methods.
2. Submittals.
3. Coordination drawings.
4. Record documents.
5. Operation and Maintenance manuals.
6. Rough-ins.
7. Mechanical installations.
8. Cutting and patching.
9. Concrete equipment base construction requirements.
10. Equipment nameplate data requirement.
11. Labeling and identifying mechanical systems and equipment is specified in "Identification for HVAC Piping and Equipment."
12. Non-shrink grout for equipment installations.
13. Field-fabricated metal and wood equipment supports.
14. Installation requirements common to equipment specification Sections.
15. Touchup painting and finishing.

1.03 ACRONYMS

A. The following list of abbreviations are utilized within the specifications and are provided as a reference:

AABC	Associated Air Balance Council
ADA	American Disability Act
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators
CS	Commercial Standard
IEEE	Institute of Electrical and Electronics Engineers
FBCM	Florida Building Code – Mechanical

FBCP	Florida Building Code – Plumbing
MSSP	Manufacturers Standards Society of the Valve and Fittings Industry
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
TEMA	Tubular Exchanger Manufacturers Association
UL	Underwriters' Laboratories

1.04 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

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

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Extended Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.05 SYSTEM DESCRIPTION

A. Design Requirements: Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.
   1. Furnish and install all items as may be required at no additional cost to fit the work to the conditions encountered.
   2. Arrange piping, ductwork, equipment and other work generally as shown on

the contract drawings, providing proper clearances and access.

3. Where departures are proposed because of field conditions or other causes, prepare and submit a detailed shop drawing submittal for approval in accordance with Submittals specified below.
4. Subject to the provisions of Division 1, Architect may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication.

1.06 SUBMITTALS

A. General: Submit each item in this Section according to the conditions of the contract and Division 01 Specification Sections.

B. Comply with the Division 01 specifications.

C. Shop Drawings and Product Data:
1. Clearly identify all submittals:
   a. Indicate intended application, location, etc.
   b. Each submittal shall indicate the associated specification section, and paragraphs. Do not combine product data and shop drawing submittals from different spec sections into a single submittal package, even though they may be the same distributor, vendor or part of a single material order.
   c. Clearly indicate the exact type, model number, size and special features of the proposed item.
   d. Include catalog spec sheets to completely describe proposed equipment.
   e. Factory order forms only showing the required capacities are not acceptable.
   f. Identify all options furnished to meet specifications.
   g. The Architect shall not select equipment ratings and/or options. Submittals not properly marked shall be returned without review.

D. Product Substitutions: Comply with requirements of the Division 01 Specifications.

E. Comparable Products Submission:
1. Document each request for a proposed comparable product with supporting data substantiating compliance of proposed product with Basis-of-Design product.
2. Use the attached “Comparable Product Submittal Form” in addition to the requirements specified herein.
3. Comparable products will not be reviewed without completion of the attached form.

F. Coordination Drawings
1. Prepare coordination drawings to a scale of 1/4" = 1’-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:
   a. Indicate the proposed locations of piping, valving, ductwork, equipment, and materials. Include the following:

b. Planned piping layout, including valve and specialty locations and valve stem movement.
c. Planned duct systems layout, including elbow radii and duct accessories.
d. Clearances for installing and maintaining insulation.
e. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
f. Equipment connections and support details.
g. Exterior wall and foundation penetrations.
h. Sizes and location of required concrete pads and bases.
i. Access doors.
j. Clearances at electrical components in accordance with the National Electric Code.
k. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
l. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Show all wall mounted access doors for mechanical devices.
m. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, cable trays, sprinklers, access doors and other ceiling mounted items.
n. Coordination drawings shall at a minimum include coordination with other divisions, plumbing and electric installers. Include domestic water piping (cold and hot water), natural gas piping sanitary piping, sanitary vent piping, ductwork, flexible duct, ceiling mounted air devices, lights, ceiling and building structural members (floor slabs, beams, joists, etc.).
o. Submit ductwork fabrication drawings.

G. Closeout Submittals:
1. Record Drawings: Prepare record documents in accordance with the requirements in the Division 01 Specifications. In addition to the requirements specified in Division 01, indicate the following installed conditions:
a. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Section 23 05 53 - “Identification for HVAC Piping and Equipment." Indicate actual inverts and horizontal locations of underground piping.
c. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
d. Approved substitutions, Contract Modifications, Responses to Contractor’s Request for Information, and actual equipment and materials installed.
e. Record the locations and invert elevations of underground installations.
2. Operation and Maintenance Data: Prepare operation and maintenance data in

accordance with the Division 01 Specifications. In addition to the requirements specified in Division 01, include the following information for equipment items:

a. List of systems and equipment requiring service manuals.
b. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
c. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
d. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
e. Servicing instructions and lubrication charts and schedules.
f. Systems and Equipment test reports.

H. Color Selection: Color of finishes shall be as selected by the Architect. Submit color charts of any factory finished equipment specified for color for acceptance prior to ordering.

I. Products and Materials:
1. Submit complete descriptive data for all materials as follows:
a. Material specifications.
b. Data sheets.
c. Samples.
d. Capacity ratings.
e. Performance curves.
f. Operating characteristics.
g. Catalog cuts.
h. Dimensional drawings.
i. Wiring diagrams.
j. Installation instruction.
k. Any other information necessary to indicate compliance with contract documents.
2. Highlight submittal data specifically for application to this project.
3. Submit actual operating conditions and characteristics for all equipment.
4. Catalogs or catalog cuts are not acceptable unless the particular item and all relative data has been marked in such a manner as to be clearly defined.
5. Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.
6. No mechanical item shall be fabricated, purchased, delivered to the site or installed, until reviewed by the Architect.
a. After the proposed materials have been approved, no substitution will be permitted except where approved by the Architect.
7. Provide shop drawing and product data submittals as indicated under individual specification sections.
8. Provide any other data requested by the Architect.

1.07 QUALITY ASSURANCE

A. Underwriter's Laboratory (UL) Requirements: All equipment containing electrical components and provided under Division 16 shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.

1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a listed label at the installer's expense.
   a. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.
   b. Provide services of a UL recognized, independent Electrical Testing Laboratory (ETL) to provide field inspection and testing. Provide and ETL Label on all such equipment.

B. Fire Safe Materials: Unless otherwise indicated, materials shall conform to UL, National Fire Protection Association (NFPA) or American Society for Testing and Materials (ASTM) standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

C. Flow rate tolerance for HVAC equipment are listed in the Testing Adjusting and Balancing Section.

D. Equipment Vibration tolerances: Equipment shall be factory balanced and re-balanced on site after installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Division 01 Specifications and the requirements contained herein.
1. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
2. Schedule delivery to minimize long-term storage at Project Site and to prevent overcrowding of construction spaces.
3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to Project Site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products in manner that will facilitate inspection and measurement.
7. Store materials in a manner that will not endanger project structure.
8. Store products subject to damage by elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation.
9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather protection requirements for storage.

1.09 PROJECT CONDITIONS

A. Outages
1. All mechanical outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon with the Owner.
2. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled with the Owner at least fourteen days (14) days in advance. All such outages shall be coordinated with the owner in writing. The owner reserves the right to partially occupy the building. Provide all necessary bypasses, isolation valves and dampers and other means and methods to limit

the amount of time the building is without services.

3. The bid price shall include the cost of all premium time required for outages and other work which interferes with the normal use of the building.
4. The operation of valves or switches required to achieve an outage shall be accomplished by the Contractor in the Owner's presence. Unauthorized operation of valves, power switches, or other control devices shall not be permitted.

1.10 SEQUENCING

A. Coordinate mechanical equipment installation with other building components and trades.

B. Coordinate for openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces.

1.11 PRODUCT WARRANTIES

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

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include project-specific information and properly executed.
2. Refer to Divisions 02 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in the Division 01 Specifications.

1.12 DISCREPANCIES

A. Where discrepancies occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost

shall be included in the contract price. The Architect shall determine the manner in which the work shall be provided, based on the design intent of the documents.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with Contract Documents that are undamaged and new at time of installation.
   1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Where products are accompanied by the term as selected, Architect will make selection.
   4. Where products are accompanied by the term match sample, sample to be matched is Architect's.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. General Compliance Requirements: Compliance requirements for individual products, as indicated in Contract Documents, are multiple in nature and may include generic descriptions, performance requirements, compliance with reference standards, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.

C. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.

D. Products specified by Reference Standards, Codes and Regulations: Select from among products, which can be shown to comply with referenced documents.

E. Products specified by Naming Products and Manufacturers: Select from among products listed.

F. Products specified by Naming One Manufacturer's Product as the Basis-of-Design with Reference to Other Manufacturers: Select either the specified Basis-of-Design product or an approved comparable product by one of the other named manufacturers.
   1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named manufacturers.

G. Products specified by Naming One Manufacturer's Product and Indicating Option of Selecting Comparable Products by stating or Approved Equivalent or similar language: Select either the specified product or an approved comparable product.
   1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named or un-named manufacturers.

H. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and, matches Architect's sample. Architect's decision will be final on whether proposed product matches

satisfactorily.

I. Visual Selection Specification: Where Specifications include the phrase as selected from manufacturer's standard colors, patterns, textures or similar phrase, select a product that complies with other specified requirements. Architect will select color, pattern, and texture.
   1. Standard Range: Where Specifications include the phrase standard range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase full range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

A. Where Basis-of-Design products are specified by name, submit the following, in addition to other required submittals, to obtain approval of a comparable product by one of the named manufacturers:
   1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work. Use the attached Comparable Products Submittal Form in addition to requirements listed herein.
   2. Detailed comparison of significant qualities of proposed product with the Basis-of- Design product in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, serviceability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

2.03 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B, “Packaged Dry, Hydraulic-Cement Grout (Nonshrink)”.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.04 ACCESS DOORS AND PANELS

A. Provide manufactured steel door assemblies consisting of:
   1. Hinged door.
   2. Flush screwdriver camlocks and frame.

B. Doors shall be Milcor Metal Access doors. Provide key locks where indicated.

C. Design shall be provided for the following installations:
   1. Masonry or Dry Wall: Style M.
   2. Hard Finish Plaster: Style AP.
   3. Fire rated dry wall ceilings: Style CFRAD, 1 hour combustible floor ceiling

system, 1 hour non-combustible floor ceiling system, 3 hour non-combustible floor ceiling system.

4. Suspended ceilings: Style CT.

PART 3 - EXECUTION

3.01 PREPARATION

A. Interface With Site Utility Companies:

1. Contact UTILITY prior to any excavation or underground work.
2. Contact local utility companies (gas, water, sewer, etc.) immediately upon award of contract. Do not install related equipment until fully coordinated with appropriate utilities.
3. Provide all construction schedules, dates of requested services, outage windows, equipment locations, etc. necessary for utility work.

3.02 INSTALLATION

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
6. Where systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

B. Rough-In

1. Verify final locations for rough-ins with field measurements and with the

requirements of the actual equipment to be connected.

2. Refer to equipment specifications in Divisions 02 through 16 for rough-in requirements.

C. Housekeeping and Equipment Pads

1. Construct pads of dimensions indicated, but not less than 4 inches (100 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.70MPa), 28-day compressive strength concrete and reinforcement bars. Refer to Division 03 Specifications and plan details for additional requirements.

D. Erection of Metal Supports and Anchorage

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1, "Structural Welding Code -Steel", 2001.

E. Erection of Wood Supports and Anchorage

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

F. Grouting

1. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
2. Clean surfaces that come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout to completely fill equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

G. Lintels

1. Lintels shall be provided for openings in masonry, brick, concrete, etc. walls to accommodate work of this division.
   a. Lintels shall be provided under this division when not being provided under other divisions. Lintels shall be approved by the Architect.

3.03 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Specifications. In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect

adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, ductwork, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 PAINTING AND FINISHING

A. Refer to Division 09 Specifications.

B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Do not paint manufacturer's labels or tags.

3.05 CONSTRUCTION

A. Cutting, Welding, Burning

1. If required, before commencing any cutting, welding, burning, brazing (pipe sweating), obtain a hot work permit from Environmental Health and Safety.
2. If required, the hot work permit copy shall remain on the job site at the hot work location until such work is completed at which time the permit shall be returned to Environmental Health and Safety.

3.06 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.

B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.07 EXCAVATION AND BACKFILLING

A. General

1. Perform all necessary excavation, for installation of work under Division 15, in accordance with Division 02.

3.08 CLEANING

A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.

B. Provide factory applied finish where specified.

C. Protect all finishes, and restore all finishes to their original condition if damaged as a result of work under Division 23.

D. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces.

E. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.

F. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

G. Remove all mechanical clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles, in access panel, roof, etc.

3.09 PROTECTION

A. Protect work, material and equipment from weather and construction operations before and after installation.

B. Properly store and handle all materials and equipment.

C. Cover temporary openings in piping, ductwork and equipment to prevent the entrance of water, dirt, debris, and other foreign matter.

3.10 LUBRICATION

A. All bearings, motors and all equipment requiring lubrication shall be provided with accessible fittings.

B. Before turning over the equipment to the Owner, provide the following:

1. Fully lubricate each item of equipment.
2. Provide 1 year's supply of lubricant for each type of lubricant.
3. Provide complete written lubricating instructions, together with diagram locating the points requiring lubrication.

C. Motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal extended grease fittings and drain plugs.

3.11 ELECTRICAL WORK

A. It is the intent to provide a complete and operational system. The work between Division 15 and 16 is complementary and is meant to produce a single and operating

system. Contractor shall make its own determination as to the distribution of responsibility among the various trades.

B. All electrical work performed under Division 15 shall be provided in accordance with Division 16.

3.12 PROVISIONS FOR ACCESS

A. Furnish and install adequate access to all HVAC and plumbing components. The following list shall be used as a guide only:
1. Mechanical equipment.
2. Valves.
3. Dampers and operators.
4. Filters.
5. Heating and air conditioning units.
6. Controls.
7. Cleanouts.
8. Traps.
9. Coils.

B. Access shall be adequate as determined by the Architect.

C. Refer to contract drawings where panels have been specifically located.

D. Provide additional panels for adequate access as indicated in paragraph A above.

3.13 OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing and balancing.

B. Do not operate equipment unless all proper safety devices or controls are operational.

C. Provide all maintenance and service for equipment, which is operated during construction.

D. Where specified and otherwise required, provide the services of a manufacturer's factory trained service organization to start the equipment.

E. Do not use mechanical systems for temporary services during construction unless authorized in writing by the Architect.
1. Where such authorization is granted, temporary use of equipment shall not limit or otherwise affect warranties or guarantees of the work.

F. Upon completion of work, clean and restore all equipment to new conditions and replace all filters.

3.14 DEMONSTRATION

A. Demonstrate operation and maintenance of equipment and systems to Owner’s personnel a minimum two (2) weeks prior to date of final inspection.
1. For equipment requiring seasonal operation, perform instructions for other seasons at the same time.
2. Training period shall be performed within 1 - two week period.

B. Use operation and maintenance manuals and video as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation

and maintenance.

C. Demonstrate the following:
1. Start up.
2. Operation.
3. Control.
4. Adjustment.
5. Trouble shooting.
6. Servicing.
7. Maintenance.
8. Shutdown.

D. Provide at least 40 hours of instruction to the operating personnel.
1. This instruction period shall consist of not less than five-8 hour days.
2. Time of instruction shall be designated by the Owner.
3. This instruction shall be in addition to instructional requirements of specific equipment specified elsewhere in Division 16.
4. Record all instruction periods. Provide the owner with three copies of the recordings in digital versatile disk (DVD) format.

3.15 WALL, FLOOR AND ROOF PENETRATIONS

A. All penetrations of partitions, walls, floors and roof by ducts, piping or conduit shall be sealed and caulked. Provide U.L. listed fire stopping systems at penetrations through fire rated walls and roof.

B. Coordinate with Architectural and Structural drawings for locations of all duct and pipe drops through floors and roof.

3.16 EQUIPMENT PROVIDED UNDER ANOTHER DIVISION AND BY OTHERS

A. Make all system connections required to equipment furnished and installed under another division and by others.

B. It shall be the responsibility of the Contractor to coordinate all necessary data from the equipment supplied under other Divisions.

3.17 PROJECT PUNCH OUT

A. Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer.

COMPARABLE PRODUCT SUBMITTAL FORM

Table of Compliance (Sample)
Shop Drawing and Product Data Submittal

The Contractor shall prepare a Table of Compliance Form similar in format to the sample shown below to facilitate and expedite the Shop Drawing and Product Data Review. Failure to comply with this requirement will be basis for rejecting the Submittal.

The Table of Compliance Form will list and compare the performance parameters as the submitted equipment to that listed on equipment schedule and specifications as basis of design. All non-compliance items (differences) must be explained in full, indicating their impact, if any, on maintainability, durability, energy use, operating costs, code compliance and environmental considerations.

(Sample)
TABLE OF COMPLIANCE

EQUIPMENT: _____ SPEC. SECTION: _____

BASIS OF DESIGN SAMPLE ITEMS	DRAWINGS	SUBMITTED	EXPLANATION
Flow (Cfm Or Gpm)			
Ext. Static Press.			
Head (Ft.)			
Electrical Requirements			
Cooling Capacity			
Heating Capacity			
Discharge Air Temp.			
Filter Type & Eff.			
Equipment Eff. (Eer)			
Sound Data			
Weights			
Etc.			
Specifications:			
A. Quality assurance compliance (ARI)			
(ASHRAE)			
(AMCA)			
B. Specifications: List each and every specification paragraph			
C. Etc.			

END OF SECTION

SECTION 15080

HVAC INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the contract, including General and Supplemental Conditions and Division 01 Specifications, apply to this section and all sections of Division 15.

1.2 SUMMARY

A. Section includes:
1. Insulation Materials:
a. Flexible elastomeric.
b. Mineral fiber.
2. Adhesives.
3. Mastics.
4. Sealants.
5. Factory-applied jackets.
6. Field-applied fabric-reinforcing mesh.
7. Field-applied jackets.
8. Tapes.
9. Securements.
10. Corner angles.

1.3 REFERENCES
(Unless otherwise noted, references apply to "latest editions.")

A. ASTM:
1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
4. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
5. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
6. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
9. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
10. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

11. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber).
12. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
13. ASTM 1622 – 08 Standard Test Method for apparent density, apparent density, apparent overall density.
14. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
15. ASTM D3575 – 08 Standard Test Methods for flexible celluar materials made from Olefin Polymers, closed cell materials, flexible cellular, Olefin Polymers, Buoyancy,etc.
16. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
20. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 SUBMITTALS

A. General: Submit each item in this Section according to the conditions of the Contract and Division 01 specification sections.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Samples: Submit two samples of representative size illustrating each insulation type.

D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.

C. Maintain one copy of each document on site.

D. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory

label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke developed index of 150 or less.

E. Insulation materials shall be tested and rated according to ASTM Test Method C-177 to determine k-factors. ASTM C 335 is for pre-formed pipe insulation. C177 is for flat slab materials such as board products, etc.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience and service facilities within 50 miles of the project.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

C. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

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 damage, by storing in original wrapping. Remove and replace any wet or damaged unsatisfactory insulation at the Architect’s direction.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Furnish five year manufacturer warranty for manmade fiber.

1.11 DEFINITIONS

A. ASJ: Al-service jacket.

B. FSK: Foil, scrim, Kraft paper.

C. FSP: Foil, Scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

F. ASJ: All service jacket composed of aluminum foil reinforced with glass scrim bonded to a Kraft paper interweaving with an outer film layer leaving no paper exposed.

G. PSK: Poly Scrim Kraft.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles blow introduce lists, the following requirements apply to product selection.
1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 execution schedule for requirements regarding where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, mercury compounds, or formaldehyde.

C. Foam insulation materials shall not utilize CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Closed-cell polyolefin/polyethylene insulation is not acceptable as a substitution for ASTM C534 closed-cell rubber materials.
1. Products:
a. Aeroflex USA Inc.: Aerocel.
b. Armacell LLC; AP Armaflex.
c. Nomaco; K-Flex Pipe
2. Water Vapor Permeability: 0.02 perm-inch per ASTM E96 Procedure A.
3. Warranty: 25 year warranty against breakdown of the membrane due to
4. ultraviolet radiation.
5. Seal Tape: Thermoplastic rubber membrane backed with pressure sensitive
6. adhesive.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.
1. Products:
a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite Duct Wrap or Microlite XG.

c. Knauf Insulation; Friendly Free Duct Wrap with Ecose® Technology.
d. Owens Corning; All-Service Duct Wrap Type 100.

2. Maximum K-Factor: 0.24 at 75 deg. F. and material thickness compressed 25%.
3. Minimum Density: 1.5 pounds per cubic foot.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:
   a. CertainTeed Corp.; Commercial Board.
   b. Johns Manville; 800 Series Spin-Glas, Type 814.
   c. Knauf Insulation; Insulation Board with Ecose® Technology, suitable for operating temperatures up to 450°F.
   d. Knauf Insulation: Elevated Temperature Board with Ecose® Technology for operating temperatures to 1000°F.
   e. Owens Corning; Fiberglas 700 Series for operating temperatures up to 450°F.
   f. Owens Corning: Insul-Quick for operating temperatures up to 850°F.
2. Maximum K-Factor: 0.23 at 75° F.
3. Minimum density: 3.0 pounds per cubic foot.

2.3 ADHESIVES

A. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II,Class I.

1. Products:
   a. Armacell LCC; 520 BLV Adhesive.
   b. Foster Products Corporation, H. B. Fuller Company; 85-60.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:
   a. Foster Products Corporation, H. B. Fuller Company; 30-90.
   b. Eagle Bridges - Marathon Industries, Inc.; 590.
   c. Mon-Eco Industries, Inc.; 55-40.
   d. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK Sealants:

1. Products:
   a. Foster Products Corporation, H. B. Fuller Company; 95-44.

b. Eagle Bridges - Marathon Industries, Inc.; 405.
c. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
1. Products:
a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.

C. Self-Adhesive Outdoor Jacket: 60-mil thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with stucco-embossed aluminum-foil facing.
1. Products:
a. Polygaurd; Alumaguard 60.
b. MFM Building Products Corp., Flex Clad 400.
c. Venture Clad Jacketing.

D. Rubber Membrane: 48-mil thick membrane consisting of a glass fiber carrier coated on both sides with liquid PVC-P Plastisol, and laminated to polyester fleece.

E. Pipe Sound Lagging: Loaded vinyl with fibrous glass scrim reinforced aluminum foil facing over 2-inch thick quilted fiberglass decoupler. Loaded vinyl shall be 2 psf minimum surface weight. Glass fiber pipe wrap shall be semi-rigid, preformed type, 2- inch minimum thickness, 1-1/2 pcf density.
1. Manufacturers:
a. Kinetics.
b. Sound Seal.
2. Sound Transmission Class (STC) Rating: 26.

F. Duct Sound Lagging: Reinforced, loaded vinyl noise barrier.
1. Products:

a. Kinetics; KNM-100 AL
b. Sound seal; B-10R
c. Unger Technologies, Inc.; Model DL-10-LAG
2. Sound Transmission Class (STC) rating: 26.
3. Density: 1 pound per square foot.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
1. Products:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to the Division 01 specifications for coordination and project conditions.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Install insulation continuously through hangers and around anchor attachments.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at anchors and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges

of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive selfsealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

N. Cut and install insulation in a manner to avoid compressing insulation more than 25 percent of its original nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. Replace insulation on existing piping, and equipment where indicated on the drawings. Match insulation type and thickness indicated by the insulation schedule at the end of this section.

R. Replace insulation on new and existing piping, and equipment where insulation is damaged during construction or removed for testing and balancing work.

S. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.
7. Unions.
8. Flanges.
9. Expansion joints.

T. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.4 BUILDING PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, and Unions:
1. Install insulation over fittings, valves, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Fittings shall be insulated to same thickness as the adjoining insulation. Apply fittings per fitting manufacturer's instructions. When required by specification, a hard insert of sufficient length shall be utilized to avoid compression of the insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
7. Stencil or label the outside insulation jacket of each union with the word UNION." Match size and color of pipe labels.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: after adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed work.

3.9 INSULATION APPLICATION SCHEDULE

A. Acceptable insulation materials, thickness and vapor retarder requirements are identified for each application and size range. If more than one material is listed for an application and size range, selection from the materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Below-grade piping.
2. General exhaust ductwork
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 HVAC PIPING INSULATION APPLICATION SCHEDULE:

HVAC SERVICE	TYPES OF INSULATION MATERIAL	INSULATION THICKNESS REQUIRED	VAPOR RETARDER REQUIRED
INDOOR REFRIGERANT SUCTION, HOT GAS PIPING AND ALL REFRIGERENT PIPING CONNECTED TO THE VRF SYSTEM (Refer to Note 1)			
All sizes, Generally	Flexible Elastomeric	½″	Yes
All sizes	Flexible Elastomeric	1″	Yes

3.11 HVAC DUCTWORK INSULATION APPLICATION SCHEDULE

HVAC SERVICE	TYPES OF INSULATION MATERIAL	INSULATION THICKNESS REQUIRED	VAPOR RETARDER REQUIRED
SUPPLY-AIR DUCTS AND PLENUMS			
Indoor Service: (Refer to Note 1)			
Concealed	Mineral-Fiber Blanket	1-1/2″	Yes
Exposed	Mineral-Fiber Board	1-1/2″	Yes
Attic Spaces and Unconditioned Spaces	Mineral-Fiber Board	2″	Yes
INDOOR RETURN-AIR DUCTS, AND PLENUMS			
In locations other than attics and unconditioned spaces	None	--	--

Attic Spaces and Unconditioned Spaces	Mineral-Fiber Board	1″	Yes
Conditioned ventilation ductwork			
Indoor Service:			
In locations other than attics and unconditioned spaces	None	–	--
Attic Spaces and Unconditioned Spaces	Mineral-Fiber Board	1″	Yes

Schedule Notes:

1. Unconditioned spaced include locations where summer temperature and humidity conditions are similar to outdoor conditions (such as mechanical rooms ventilated with unconditioned outdoor air)
2. **All diffuser cones, HVAC equipment, coils, coil headers, casings, plenums, air measuring devices, etc. shall be insulated.**

3.12 FIELD APPLIED JACKET APPLICATION SCHEDULE

SERVICE	**FIELD APPLIED JACKET TYPE**
Indoor, exposed insulated piping within 12 feet of floor, for service temperatures 200 degrees F and below	Aluminum
Indoor, exposed insulated piping greater than 12 feet above floor, generally	None
Indoor concealed piping	None
Outdoor exposed piping	PVC
Indoor, All Locations, Fittings and valves in piping systems at service temperatures 200 degrees F and below	Factory Fabricated PVC covers
Indoor, All Locations, Fittings and valves in piping systems at service temperatures 200 degrees F and below	Aluminum
SERVICE	**FIELD APPLIED JACKET TYPE**

Indoor, exposed insulated ductwork within 12 feet of floor	Woven Glass Fiber Fabric
Indoor, concealed insulated ductwork	None
All insulated piping within custom AHU service corridors for service temperatures 200 degrees F and below	PVC
All insulated piping within custom AHU service corridors for service temperatures 200 degrees F and below	Aluminum
Equipment, generally (Refer to Notes 1 & 2)	Woven Glass Fiber Fabric
Equipment, Cold surface (Refer to Notes 1 & 2)	PVC

Jacket Application Schedule Notes:

1. Refer to Part 3 specification section titled "Mechanical Equipment, Tank, and Vessel Insulation Installation" for requirements for revocable, re-usable metal boxes lined with insulation at pumps.
2. Including factory insulated equipment without factory applied jacket.

END OF SECTION

SECTION 15400

COMMON WORK FOR PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this and the other sections of Division 15.

1.2 SUMMARY

A. Section includes:

1. General administrative and procedural requirements, as well as the following basic plumbing materials and methods.
2. Submittals.
3. Coordination drawings.
4. Record documents.
5. Operation and Maintenance manuals.
6. Rough-ins.
7. Plumbing installations.
8. Cutting and patching.
9. Concrete equipment base construction requirements.
10. Equipment nameplate data requirement.
11. Non-shrink grout for equipment installations.
12. Field-fabricated metal and wood equipment supports.
13. Installation requirements common to equipment specification Sections.
14. Plumbing demolition.
15. Touchup painting and finishing.

1.3 ACRONYMS

A. The following list of abbreviations are utilized within the specifications and are provided as a reference:

ADA	-	American Disability Act
ANSI	-	American National Standards Institute
ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWS	-	American Welding Society
AWWA	-	American Water Works Association
BOCA	-	Building Officials and Code Administrators
CS	-	Commercial Standard
IBR	-	Institute of Boiler and Radiator Manufacturers
IEEE	-	Institute of Electrical and Electronics Engineers
FBCM	-	Florida Building Code – Mechanical
FBCP	-	Florida Building Code - Plumbing
MSSP	-	Manufacturers Standards Society of the Valve and Fittings Industry

NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
OSHA	-	Occupational Safety and Health Administration
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
TEMA	-	Tubular Exchanger Manufacturers Association
UL	-	Underwriters' Laboratories
FBC	-	Florida Building Code

1.4 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

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

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Extended Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.5 SYSTEM DESCRIPTION

A. Design Requirements: Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.

   1. Furnish and install all items as may be required at no additional cost to fit the work to the conditions encountered.
   2. Arrange piping, equipment and other work generally as shown on the contract

drawings, providing proper clearances and access.

3. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawing submittal for approval in accordance with Submittals specified below.
4. Subject to the provisions of Division 01, Architect may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication.

1.6 SUBMITTALS

A. General: Submit each item in this Section according to the conditions of the contract and Division 00 and Division 01 Specification Sections.

B. Shop Drawings and Product Data:

1. Clearly identify all submittals:
   a. Indicate intended application, location, etc.
   b. Each submittal shall indicate the associated specification section, and paragraphs. Do not combine product data and shop drawing submittals from different spec sections into a single submittal package, even though they may be the same distributor, vendor or part of a single material order.
   c. Clearly indicate the exact type, model number, size and special features of the proposed item.
   d. Include catalog spec sheets to completely describe proposed equipment.
   e. Factory order forms only showing the required capacities are not acceptable.
   f. Identify all options furnished to meet specifications.
   g. If product is within system supplying fixture intended to dispense potable water for human consumption, including drinking and cooling, submittals shall indicate that product is “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
   h. Solder and flux for soldered joints in potable water piping shall be “lead free”, containing not more than 0.2% lead.
   i. The Architect shall not select equipment ratings and/or options. Submittals not properly marked shall be returned without review.

C. Product Substitutions: Comply with requirements of Division 01.

D. Comparable Products Submission:

1. Document each request for a proposed comparable product with supporting data substantiating compliance of proposed product with Basis-of-Design product.
2. Use the attached “Comparable Product Submittal Form” in addition to the requirements specified herein.
3. Comparable products will not be reviewed without completion of the attached form.

E. Coordination Drawings

1. Prepare coordination drawings to a scale of 1/4" = 1′-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

a. Indicate the proposed locations of piping, valving, ductwork, equipment, and materials. Include the following:
b. Planned piping layout, including valve and specialty locations and valve stem movement.
c. Planned piping systems layout, including valves and accessories.
d. Clearances for installing and maintaining insulation.
e. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
f. Equipment connections and support details.
g. Sizes and location of required concrete pads and bases.
h. Access doors.
i. Clearances at electrical components in accordance with the National Electric Code.
j. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
k. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Show all wall mounted access doors for plumbing devices.
l. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, cable trays, sprinklers, access doors and other ceiling mounted items.
m. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, cable trays, sprinklers, access doors and other ceiling mounted items.
n. Coordination drawings shall at a minimum include coordination with Division, 15 and Division 16 installers. Include domestic water piping (cold water, hot water and hot water re- circulation), sanitary piping, sanitary vent piping, ductwork, flexible duct, ceiling mounted air devices, lights, ceiling and building structural members (floor slabs, beams, joists, etc.).

F. Closeout Submittals:

1. Record Drawings: Prepare record documents in accordance with the requirements in the Division 01 specifications. In addition to the requirements specified in Division 01, indicate the following installed conditions:
   a. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
   b. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   c. Approved substitutions, Contract Modifications, Responses to Contractor's Request for Information, and actual equipment and materials installed.
   d. Record the locations and invert elevations of underground installations.
2. Operation and Maintenance Data: Prepare operation and maintenance data in accordance with Division 01 specifications. In addition to the requirements specified in Division 01, include the following information for equipment items:
   a. List of systems and equipment requiring service manuals.
   b. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

c. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
d. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
e. Servicing instructions and lubrication charts and schedules.
f. Systems and Equipment test reports.

G. Color Selection: Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.

H. Products and Materials:
1. Submit complete descriptive data for all materials as follows:
a. Material specifications.
b. Data sheets.
c. Samples.
d. Capacity ratings.
e. Performance curves.
f. Operating characteristics.
g. Catalog cuts.
h. Dimensional drawings.
i. Wiring diagrams.
j. Lead Free, for potable water service.
k. Installation instruction.
l. Any other information necessary to indicate compliance with contract documents.
2. Edit submittal data specifically for application to this project.
3. Submit actual operating conditions and characteristics for all equipment.
4. Catalogs or catalog cuts are not acceptable unless the particular item and all relative data has been marked in such a manner as to be clearly defined.
5. Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.
6. No plumbing item shall be fabricated, purchased, delivered to the site or installed, until reviewed by the Architect/Engineer
a. After the proposed materials have been approved, no substitution will be permitted except where approved by the Architect.
7. Provide shop drawing and product data submittals as indicated under individual specification sections.
8. Provide any other equipment requested by the Architect/Engineer.

1.7 QUALITY ASSURANCE

A. Underwriter's Laboratory (UL) Requirements: All equipment containing electrical components and provided under Division 15 shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.

1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a listed label at the installer's expense.
a. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.
b. Provide services of a UL recognized, independent Electrical Testing Laboratory (ETL) to provide field inspection and testing. Provide and ETL Label on all

such equipment.

B. Fire Safe Materials: Unless otherwise indicated, materials shall conform to UL, National Fire Protection Agency (NFPA) or American Society for Testing and Materials (ASTM) standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with Division 01 specifications.
1. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
2. Schedule delivery to minimize long-term storage at Project Site and to prevent overcrowding of construction spaces.
3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to Project Site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products in manner that will facilitate inspection and measurement.
7. Store materials in a manner that will not endanger project structure.
8. Store products subject to damage by elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation.
9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather protection requirements for storage.

1.9 PROJECT CONDITIONS

A. Existing Conditions: Prior to preparing the bid, visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and all other matters, which can affect the work. No additional compensation will be made for failure to determine the conditions under which the work will be performed.

B. Outages
1. All plumbing outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon with the Owner.
2. Unless otherwise specified, outages of any services in adjacent buildings required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled with the Owner at least fourteen days (14) days in advance. All such outages shall be coordinated with the owner in writing.
The owner reserves the right to partially occupy the building. Provide all necessary bypasses, isolation and other means and methods to limit the amount of time the building is without services.
3. The bid price shall include the cost of all premium time required for outages and other work which interferes with the normal use of the building.
4. The operation of valves or switches required to achieve an outage shall be accomplished by the Contractor in the Owner's presence. Unauthorized operation of valves, power switches, or other control devices shall not be permitted.

1.10 SEQUENCING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where plumbing items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.11 PRODUCT WARRANTIES

A. Comply with all requirements contained in the Division 01 Specifications and all requirements contained herein and other sections of Division 22.

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

C. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include project-specific information and properly executed.
   2. Refer to Divisions 02 thru 48 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Submittal Time: Comply with requirements in the Division 01 Specifications.

1.12 DISCREPANCIES

A. Comply with the requirements set forth in the Division 01 specifications and contained herein.

B. Where discrepancies occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall

be included in the contract price. The Architect shall decide on the item and manner in which the work shall be provided, based on the design intent of the documents.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with Contract Documents that are undamaged and new at time of installation.
   1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Where products are accompanied by the term as selected, Architect will make selection.
   4. Where products are accompanied by the term match sample, sample to be matched is Architect's.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. General Compliance Requirements: Compliance requirements for individual products, as indicated in Contract Documents, are multiple in nature and may include generic descriptions, performance requirements, compliance with reference standards, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.

C. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.

D. Products specified by Reference Standards, Codes and Regulations: Select from among products, which can be shown to comply with referenced documents.

E. Products specified by Naming Products and Manufacturers: Select from among products listed.

F. Products specified by Naming One Manufacturer's Product as the Basis-of-Design with Reference to Other Manufacturers: Select either the specified Basis-of-Design product or an approved comparable product by one of the other named manufacturers.
   1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named manufacturers.

G. Products specified by Naming One Manufacturer's Product and Indicating Option of Selecting Comparable Products by stating or Approved Equivalent or similar language: Select either the specified product or an approved comparable product.
   1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named or un-named manufacturers.

H. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and, matches Architect's sample. Architect's decision will be final on whether proposed product matches satisfactorily.

I. Visual Selection Specification: Where Specifications include the phrase as selected from manufacturer's standard colors, patterns, textures or similar phrase, select a product that complies with other specified requirements. Architect will select color, pattern, and texture.
   1. Standard Range: Where Specifications include the phrase standard range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase full range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Where Basis-of-Design products are specified by name, submit the following, in addition to other required submittals, to obtain approval of a comparable product by one of the named manufacturers:
   1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work. Use the attached Comparable Products Submittal Form in addition to requirements listed herein.
   2. Detailed comparison of significant qualities of proposed product with the Basis-of-Design product in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, serviceability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

2.3 GROUT

A. Comply with requirements in the Division 03 Specifications and contained herein.

B. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B, "Packaged Dry, Hydraulic-Cement Grout (Nonshrink)".
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.4 ACCESS DOORS AND PANELS

A. Comply with the requirements set forth in the Division 08 Specifications and contained herein.

B. Provide manufactured steel door assemblies consisting of:
   1. Hinged door.
   2. Flush screwdriver camlocks and frame.

C. Doors shall be Milcor Metal Access doors. Provide key locks where indicated.

D. Design shall be provided for the following installations:

1. Masonry or Dry Wall: Style M.
2. Hard Finish Plaster: Style AP.

PART 3 EXECUTION

3.1 PREPARATION

A. Interface with Site Utility Companies:
   1. Contact local utility companies (gas, water, sewer, etc.) immediately upon award of contract. Do not install related equipment until fully coordinated with appropriate utilities.
   2. Provide all construction schedules, dates of requested services, outage windows, equipment locations, etc. necessary for utility work.
   3. Water and Sewer Utilities:
      a. Coordinate flow, usage and pressure requirements with local water and sewer authorities as necessary to obtain services.

3.2 INSTALLATION

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange openings in other building components during progress of construction, to allow for mechanical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
   10. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
   11. Install access panel or doors where units or valves are concealed behind finished surfaces. Access panels and doors are specified in Division 08 and herein.
   12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

B. Rough-In
1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
2. Refer to equipment specifications in other Divisions for rough-in requirements.

C. Housekeeping and Equipment Pads
1. Comply with the requirements in the Division 03 Specifications and contained herein.
2. Construct pads of dimensions indicated, but not less than 4 inches (100 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.70MPa), 28-day compressive strength concrete and reinforcement bars.

D. Erection of Metal Supports and Anchorage
1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1, "Structural Welding Code -Steel".

E. Erection of Wood Supports and Anchorage
1. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

F. Grouting
1. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
2. Clean surfaces that will come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout to completely fill equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

G. Lintels
1. Lintels shall be provided for openings in masonry, brick, concrete, etc. walls to accommodate work of this division.
   a. Lintels shall be provided under this division when not being provided under other divisions. Lintels shall be approved by the Architect.

H. Water Heaters:
1. Installation of water heaters, expansion tanks and all other pressure vessels shall be made in compliance with all state code requirements.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with the Division 01 Specifications. In addition to the requirements specified in Division 01, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Patch finished surfaces and building components using new materials specified for the original installation and using experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Do not paint manufacturer's labels or tags.

3.5 CONSTRUCTION

A. Cutting, Welding, Burning
1. If required, before commencing any cutting, welding, burning, brazing (pipe sweating), obtain a hot work permit from Environmental Health and Safety.
2. If required, the hot work permit copy shall remain on the job site at the hot work location until such work is completed at which time the permit shall be returned to Environmental Health and Safety.

3.6 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.

B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.7 EXCAVATION AND BACKFILLING

A. General
1. Perform all necessary excavation, for installation of work under this division in accordance with FBCP and Division 02.

3.8 CLEANING

A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.

B. Provide factory applied finish where specified.

C. Protect all finishes, and restore all finishes to their original condition if damaged as a result of work.

D. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces.

E. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.

F. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

G. Remove all plumbing clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

3.9 PROTECTION

A. Protect work, material and equipment from weather and construction operations before and after installation.

B. Properly store and handle all materials and equipment.

C. Cover temporary openings in piping, ductwork and equipment to prevent the entrance of water, dirt, debris, and other foreign matter.

3.10 LUBRICATION

A. All bearings, motors and all equipment requiring lubrication shall be provided with accessible fittings.

B. Before turning over the equipment to the Owner, provide the following:
1. Fully lubricate each item of equipment.
2. Provide 1 year's supply of lubricant for each type of lubricant.
3. Provide complete written lubricating instructions, together with diagram locating the points requiring lubrication.

C. Motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal extended grease fittings and drain plugs.

3.11 ELECTRICAL WORK

A. It is the intent to provide a complete and operational system. The work between Division 15 and 16 is complementary and is meant to produce a single and operating system. Contractor shall make its own determination as to the distribution of responsibility among the various trades.

B. All electrical work performed under Division 15 shall be provided in accordance with Division 16.

3.12 PROVISIONS FOR ACCESS

A. Furnish and install adequate access to all plumbing components. The following list shall be used as a guide only:
1. Plumbing equipment.
2. Valves.
3. Cleanouts.
4. Traps.

B. Access shall be adequate as determined by the Architect.

C. Refer to contract drawings where panels have been specifically located.

D. Provide additional panels for adequate access as indicated in paragraph A above.

E. Where access is by means of liftout ceiling tiles or panels mark each panel using small color-coded or numbered tabs. Provide an index chart for identification. Place markers in corner of tile.

3.13 OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing and balancing.

B. Do not operate equipment unless all proper safety devices or controls are operational.

C. Provide all maintenance and service for equipment, which is operated during construction.

D. Where specified and otherwise required, provide the services of a manufacturer's factory trained service organization to start the equipment.

E. Do not use mechanical systems for temporary services during construction unless authorized in writing by the Architect.
1. Where such authorization is granted, temporary use of equipment shall not limit or otherwise affect warranties or guarantees of the work.

F. Upon completion of work, clean and restore all equipment to new conditions and replace all filters.

3.14 DEMONSTRATION

A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel a minimum two (2) weeks prior to date of final inspection.
1. For equipment requiring seasonal operation, perform instructions for other

seasons at the same time.

2. Training period shall be performed within 1 - two week period.

B. Use operation and maintenance manuals and video as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate the following:
1. Start up.
2. Operation.
3. Control.
4. Adjustment.
5. Trouble shooting.
6. Servicing.
7. Maintenance.
8. Shutdown.

D. Provide at least 40 hours of instruction to the operating personnel.
1. This instruction period shall consist of not less than five-8 hour days.
2. Time of instruction shall be designated by the Owner.
3. This instruction shall be in addition to instructional requirements of specific equipment specified elsewhere in Division 15.
4. Record all training sessions. Provide the owner with three (3) copies of the recordings in digital versatile disk (DVD) format.

3.15 EQUIPMENT PROVIDED UNDER ANOTHER DIVISION AND BY OTHERS

A. Make all system connections required to equipment furnished and installed under another division and by others.

B. It shall be the responsibility of the Contractor to coordinate all necessary data from the equipment supplied under other Divisions.

3.16 PROJECT PUNCH OUT

A. Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement will be made by deducting the Architect/Engineer fee from the Contractor's final payment.

COMPARABLE PRODUCT SUBMITTAL FORM

Table of Compliance (Sample)
Shop Drawing and Product Data Submittal

The Contractor shall prepare a Table of Compliance Form similar in format to the sample shown below to facilitate and expedite the Shop Drawing and Product Data Review. Failure to comply with this requirement will be basis for rejecting the Submittal.

The Table of Compliance Form will list and compare the performance parameters as the submitted equipment to that listed on equipment schedule and specifications as basis of design. All non-compliance items (differences) must be explained in full, indicating their impact, if any, on maintainability, durability, energy use, operating costs, code compliance and environmental considerations.

(Sample)
TABLE OF COMPLIANCE

EQUIPMENT: _____ SPEC. SECTION: _____

BASIS OF DESIGN SAMPLE ITEMS	DRAWINGS	SUBMITTED	EXPLANATION
Flow (Cfm Or Gpm)			
Ext. Static Press.			
Head (Ft.)			
Electrical Requirements			
Cooling Capacity			
Heating Capacity			
Discharge Air Temp.			
Filter Type & Eff.			
Equipment Eff. (Eer)			
Sound Data			
Weights			
Etc.			
Specifications:			
A. Quality assurance compliance (ARI)			
(ASHRAE)			
(AMCA)			
(UL)			
B. Specifications: List each and every specification paragraph			
C. Etc.			
Other:			

END OF SECTION

SECTION 15651

REFRIGERANT PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other Sections of Division 15.

1.2 SUMMARY

A. Section includes:

1. Pipes, tubing, fittings, and specialties.
2. Special duty valves.
3. Refrigerants.
4. Installation of refrigerant piping.

B. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of packaged air conditioning equipment.

C. Design and installation shall be provided in accordance with equipment manufacturer's recommendations.

D. Related Sections: The following sections contain requirements that relate to this section:

1. Section 15010 - "General Mechanical Provisions": Labeling and identification of refrigerant piping.
2. Section 15061 - "Hangers and Supports for HVAC Piping and Equipment."
3. Section 15075- "Mechanical HVAC Identification."
4. Section 15080 - "HVAC Insulation".
5. Section 15990 - "Testing, Adjusting and Balancing for HVAC."

1.3 SUBMITTALS

A. General: Submit each item in this Section according to the conditions of the Contract and Division 01 specification sections.

B. Product data for the following products:
1. Each type valve specified.
2. Each type refrigerant piping specialty specified.

C. Submit Shop Drawings showing design and layout of refrigerant piping, valves, expansion valves, drains accumulators, traps, filters, and miscellaneous specialties, etc. Shop Drawings shall also include but not necessarily be limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment. Provide a letter from the equipment manufacturer certifying the design is being provided in accordance with the equipment manufacturer's criteria.

D. Brazer's Certificates signed by Contractor certifying that brazers comply with requirements specified under "Quality Assurance" below.

E. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 01.

1.4 QUALITY ASSURANCE

A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

B. Regulatory Requirements: Comply with provisions of the following codes:

1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping, latest edition.
2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration, latest edition.
3. International Mechanical and Plumbing Codes, 2009.
4. PHCC: National Standard Plumbing Code, latest edition.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Refrigerant Valves and Specialties:
   a. Alco Controls Div, Emerson Electric.
   b. Danfoss Electronics, Inc.
   c. EATON Corporation, Control Div.
   d. Henry Valve Company.
   e. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
   f. Sporlan Valve Company.

2.2 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3, Article "Pipe Application" for identification of systems where the below specified pipe and fitting materials are used.

B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

2.3 FITTING MATERIALS

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

2.4 JOINING MATERIALS

A. Brazing Filler for Joining Similar Metals: AWS A5.8, Classification BCuP series, with melting range from 1190 to 1480°F.

2.5 Brazing Filler for Joining Dissimilar Metals: AWS A5.8, Classification BAg series, with melting range from 1125 to 1370°F.

2.6 VALVES

A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.

B. Globe: 450 psig maximum operating pressure, 275°F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.

C. Check Valves - Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 °F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.

D. Check Valves - 7/8 inch and Larger: 450 psig maximum operating pressure, 300°F maximum operating temperature; cast bronze body, with cast bronze or forged brass bolted bonnet; floating piston with mechanically retained Teflon seat disc. Valve shall be straight through or angle pattern, with solder-end connections.

E. Solenoid Valves: 250°F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2 inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.

F. Evaporator Pressure Regulating Valves: pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gage tappings, 24 volts DC, 50/60 Hz, standard coil; and wrought copper fittings for solder end connections.

G. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, and an external equalizer line.

2.7 REFRIGERANT PIPING SPECIALTIES

A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.

B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.

C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200°F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.

D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as

follows:

1. Standard capacity desiccant sieves to provide micronic filtration.

E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225°F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.

F. Suction Line Filters: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter core kit, including gaskets, as follows:

G. Flanged Unions: 400 psig maximum working pressure, 330°F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.

H. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

I. Suction Accumulators: Provide as manufactured by Refrigeration Research, Inc.

2.8 REFRIGERANT: Type shall be provided to suit equipment being served.

2.9 LOCKING ACCESS PORT CAPS

A. Provide locking cap(s) with multi-key(s) for all refrigerant circuit access ports located outdoors.

B. Locking caps shall be as manufactured by Win Air Company or comparable acceptable product.

2.10 FLEX PIPE CONNECTORS

A. Unisource Series 412 flexible connectors shall be bronze braided style and U.L. Rated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

3.2 PREPARATION

A. Pre-Cleaning:

1. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:

a. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.
b. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
c. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
d. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Hangers, supports, and anchors are specified in Section 23 05 29 - "Hangers and Supports for HVAC Piping and Equipment."

3.4 INSTALLATION OF VALVING

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.

B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere in accordance with manufacturer's instructions.

C. Install a full sized, 3-valve bypass around each drier.

D. Install solenoid valves ahead of each expansion valve. Install solenoid valves in horizontal lines with coil at the top.

1. Electrical wiring for solenoid valves is specified in Division 26. Coordinate electrical requirements and connections.

E. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.

1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
4. Where external equalizer lines are required, make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.

F. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

3.5 PIPING APPLICATION

A. Provide Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Provide Type K, annealed temper copper tubing for 2 inch and smaller without joints, within enclosed areas. Mechanical fittings (crimp or flair) are not permitted.

1. Install annealed temper tubing in pipe duct. Vent pipe duct to the outside.

3.6 INSTALLATION OF PIPING

A. Size piping and install refrigerant piping, traps, specialties as necessary for a complete and operational system in accordance with equipment manufacturer's recommendations.

B. General: Install refrigerant piping in accordance with ASHRAE Standard 15 "The Safety Code for Mechanical Refrigeration". Unless specified otherwise by the Section, comply with "Installation of Piping - General" as specified in Section 15410 - "Pipes and Tubes for Plumbing Piping and Equipment".

C. Install piping in as short and direct arrangement as possible to minimize pressure drop.

D. Install piping for minimum number of joints using as few elbows and other fitting as possible.

E. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

F. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

G. Insulate suction lines. Insulate liquid lines located outside the building. Liquid lines inside the building are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

H. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

I. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

J. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.
2. Install horizontal suction lines with 1/2" per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
3. Install traps and double risers and where required in accordance with equipment manufacturer's recommendations to entrain oil in vertical runs.
4. Liquid lines may be installed level.

K. Use fittings for all changes in direction and all branch connections.

L. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

M. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

N. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

O. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1″ clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

P. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

Q. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6″ shall be steel; pipe sleeves 6″ and larger shall be sheet metal.

R. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

S. Install strainers immediately ahead of each expansion valve, solenoid valve, compressor suction valve, and as required to protect refrigerant piping system components.

T. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.
   1. Install moisture/liquid indicators in lines larger than 2 1/8″ OD, using a bypass line.

U. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

V. Install flexible connectors at the inlet and discharge connection of compressors.

W. Refrigerant circuit access ports located outdoors shall be fitted with locking-type-tamper-resistance caps.

3.7 CONSTRUCTION

A. Pipe Joints:

   1. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
      a. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
      b. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
   2. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.
   3. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

4. All refrigerant piping shall be phosphor copper brazed and not flux brazed.

B. Equipment Connections:

1. The Drawings indicate the general arrangement of piping and fittings.
2. Install piping adjacent to machine to allow servicing and maintenance.
3. Provide Flex pipe connector when connection to condensing units.

3.8 REFRIGERANT PIPING SYSTEMS

A. Inspect, test and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI, "Refrigerant Piping and Heat Transfer Components", 2001, and as follows:

1. All refrigerant tubing shall be tested before tube insulation is applied.
2. Note: The use of compressed air for pressure testing refrigerant tubing will not be permitted.
3. Refrigerant relieve valves, if installed, shall be removed prior to pressure testing and shell openings plugged. After system is tested and found to be completely tight, relief valves shall be reinstalled prior to system evacuation.
4. Each tubing system shall be pressure tested with dry nitrogen. Leaks shall be repaired by removing and remaking the defective joint. No caulking will be permitted. After repair of leaks, system shall be retested and provided tight.
5. Tubing shall be tested as a minimum of 550 psig for a 24 hour period. Suggested procedure is as follows:
   a. Charge system with oil pumped dry nitrogen to a pressure of 100 psig. Make a soap bubble test of all joints and all connections. Mark all leaks, blow down and repair all leaks.
   b. After above test and repair, charge high side with refrigerant to a pressure of 30 psig. Make a rapid leak check at this pressure using an electronic leak detector. If no leaks are found, raise pressure to 550 psig using oil pumped dry nitrogen.
   c. Leave nitrogen and refrigerant mixture overnight to permit mixing by diffusion. Check diffusion and leak tester operation by venting a flange or valve stem. Make a thorough leak test. If leaks are found, blow down, repair and retest. Continue this procedure until entire system is provided to be absolutely tight.
   d. After the refrigerant piping has been pressure tested and proven tight, and before piping insulation s applied, the entire system shall be evacuated with a vacuum pump to remove air and moisture. Evacuation shall be performed with all spaces containing refrigerant piping or equipment at no lower than 50°F.
   e. Manual valves except those open to atmosphere shall be opened and all controls such as solenoids shall be jacked open. Any gauges or pressure controls which could be damaged by a deep vacuum shall be valved off. Seal caps on valves shall be in place and tight. Any valves open to atmosphere shall be closed and capped.
   f. The entire system shall be double evacuated to 1500 microns Hg absolute as follows:
      1) When vacuum pump is started, vacuum should pull down fairly rapidly to 25,000 microns Hg absolute (28.94"). If vacuum does not pull below 25,000 microns, there are leaks in the system and leak test procedure must be repeated.
      2) At approximately 10,000 microns, evaporation of free water in the system will be rapidly accelerated and vacuum will tend to remain

constant as evaporation rate begins to equal vacuum pump capacity. Depending on amount of water, ambient temperature and vacuum pump capacity, it may take several hours to make any noticeable decrease in vacuum below 10,000 microns. During this period, apply heat to any low points or suspected points of moisture. Feel pipes for cold spots and supply heat.

3) Continue evacuation until a pressure of 1,500 microns minimum is reached, then break the vacuum and pressurize to 10 psig with oil pumped dry nitrogen as a holding charge until ready for charging.

4) When ready for charging, vent nitrogen holding charge to atmosphere and re-evacuate down to a minimum of 1,500 microns. Break vacuum with refrigerant gas. Do not use liquid.

g. Repair leaking joints using new materials, and retest for leaks.

3.9 ADJUSTING AND CLEANING

A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Clean and inspect refrigerant piping systems in accordance with industry standards.

C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.10 SYSTEM START-UP

A. Charge system using the following procedure:
1. Install core in filter dryer after leak test but before evacuation.
2. Evacuate refrigerant system with vacuum pump; until temperature of 35°F is indicated on vacuum dehydration indicator.
3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
5. Break vacuum with refrigerant gas; allow pressure to build up to 2 psi.
6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties. Training shall be a minimum of eight (8) hours performed during a regular business day with a one hour lunch break. Record all training sessions. Provide the owner with three (3) copies in digital versatile disk (DVD) format.

C. Review data in Operating and Maintenance Manuals. Refer to the Division 01 Specifications.

D. Schedule training with Owner through the Architect, with at least seven (7) days advance notice.

END OF SECTION

SECTION 15710
SPLIT SYSTEM AIR CONDITIONER-UNIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.02 DESCRIPTION OF WORK

A. This section includes furnishing and installing air cooled condensing units and air handling units with a direct expansion evaporator section and an electric heating section.

1. The work includes equipment, piping, insulation, controls, and related appurtenances for air conditioning and ventilation. Completion must result in a complete and operable system.

1.03 REFERENCES

A. Air-Conditioning and Refrigeration Institute (ARI):

1. ARI 210/240 Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. National Fire Protection Association (NFPA):

1. NFPA 90A-2002 Installation of Air Conditioning and Ventilating Systems

C. Underwriters Laboratories, Inc. (UL):

1. UL-900 Test Performance of Air Filter Units

1.04 SUBMITTALS

A. General: Submittals shall be according to Section 01300 - Submittals.

B. Manufacturer's Literature: Submit 6 copies of the manufacturer's descriptive data for units to be used on this project.

C. Operating and Maintenance Instructions: Submit 6 copies of the manufacturer's operating and maintenance instructions for the units to be used on this project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in the manufacture of air cooled condensing units and air handling units, and who issues a complete catalog of data on such products.

B. Testing Requirements: The units shall be tested for proper operation at the factory.

C. Labeling Requirements: Units shall be Underwriter's Laboratories, Inc. (UL). listed and labeled.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Approved Manufactures:

1. ADP (Basis of Design)
2. First Company

3. Trane
4. Approved Equal

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Condensing Unit:

1. Condenser coil shall be of nonferrous construction. Coil shall have aluminum fins, mechanically bonded to seamless copper tubes. Coil shall be circuited for subcooling.

2. Unit shall have direct driven propeller-type fans arranged for vertical discharge. Condenser fan motors shall have inherent protection, and shall be of the permanently lubricated type, resiliently mounted. Each fan shall have a safety guard. Controls shall be included for cycling fans for intermediate season operation.

3. Controls shall be factory wired and located in a separate enclosure. Safety devices shall consist of high and low pressure switches and compressor overload devices. Unit wiring shall incorporate a positive acting timer to prevent short cycling of compressor if power is interrupted. Timer shall prevent compressor from restarting for approximately 5 minutes after shutoff. Units shall have a transformer for 24 volt control circuit.

4. Cabinet: Casing shall make unit fully weatherproof for outdoor installation. Casing shall be of galvanized steel with baked polyester paint finished. Corner-mounted controls for easy service. Openings shall be provided for power and refrigerant connections. Panels shall be removable to provide access for servicing.

5. Only one liquid line, one suction line, and one power supply connection shall be required for each unit. External gauge ports for easy service

6.

7. Refrigerant System:
   a. Condenser fan - Direct drive fan shall move large air volumes uniformly through entire condenser coil for high refrigerant cooling capacity. Vertical air discharge shall minimize operating sounds and eliminate damage to lawn and shrubs. Fan motor shall have sleeve bearings and be inherently protected. Motor shall be totally enclosed for maximum protection from weather, dust and corrosion. Provide rain shield on motor for additional protection from moisture. Furnish with louvered steel top fan guard. Fan service access to be accomplished by removal of top panel.

8. Compressor:
   a. Provide high efficiency compressor with uniform suction flow, constant discharge flow and high volumetric efficiency and quiet operation.
   b. Compressor motor shall be internally protected from excessive current and temperature.
   c. Compressor shall be installed in the unit on resilient mounts for vibration free operation.

9. Cabinet:
   a. Provide powder paint finish for superior rust and corrosion protection.
   b. Provide sweat connection suction and liquid lines to be located on corner of unit cabinet.

10. Components: Factory installed high and low pressure switches. Thread-on pressure switches for simple, quick service. Factory installed filter dryer. Fan orifice for smoother airflow and sound level reduction.

B. Air Handling Unit:

1. Cooling coils shall be of nonferrous construction with aluminum fins mechanically bonded to seamless copper tubes. All tube joints shall be brazed with phoscopper or silver alloy.

2. Evaporator fan section shall have forward-curved blades, double-inlet fans. Fans shall be statically and dynamically balanced and supplied with permanently lubricated bearings.

3. The casing shall be constructed of heavy-gauge, corrosion-resistant galvanized steel. Refrigerant connections located on top left. 5/8" foil-faced insulation for sweat resistance and quiet operation. (4) Screw removal for easy access to all electrical connections. Dual condensate drain connections on left side, right side, and bottom of cabinet. 1" duct flanges on all models simplify attachment to plenums such as 1 1/2" ductboard. Air filter included with every air handler; no tools required for changeout. Decorative wall panel or closet panel available as accessory; to reduce published sound level. Wall hanging bracket for field installation.

4. Refrigerant System:
   a. Refrigerant Line Connections: Suction (vapor) and liquid lines shall have sweat connections that extended outside of the cabinet for ease of connection.
   b. Provide check and expansion valve for use with R-410A systems, wide range valve with factory installed fittings.

5. Blower:
   a. Provide 5 speed high efficiency ECM motor to maintain specified air volume throughout external static range. Speeds may be field selected on depending on blower coil unit size and air volume desired.

6. Filter: Provide tool-less access to filter area for quick and easy servicing. Disposable frame type filter shall be furnished and factory installed in rails in cabinet.

7. Cabinet: The casing shall be constructed of heavy-gauge, corrosion-resistant galvanized steel. Refrigerant connections located on top left. 5/8" foil-faced insulation for sweat resistance and quiet operation. (4) Screw removal for easy access to all electrical connections. Dual condensate drain connections on left side, right side, and bottom of cabinet. 1" duct flanges on all models simplify attachment to plenums such as 1 1/2" ductboard. Air filter included with every air handler; no tools required for changeout. Decorative wall panel or closet panel available as accessory; to reduce published sound level. Wall hanging bracket for field installation.

8. Electric Heat: Electric heat shall be factory installed on unit cabinet of 5, 7.5, or 10 kW. Helix wound Nichrome heating elements shall be exposed directly in air stream resulting in instant heat transfer, low element temperatures and long service life. Each element shall be equipped with accurately located limit control with fixed temperature off setting and automatic reset. Provide supplemental thermal cutoff limit control for positive protection in case of excessive temperatures. Provide thermal sequencer relay to bring elements on and off line, in sequence and equal increments, with time delay between each. Initiates and terminates blower operation. Heating control relay(s) shall be furnished as standard. Control box and access cover to be constructed of heavy gauge galvanized steel. Factory assembled with controls installed and wired. Electric heat low voltage controls shall plug-in to blower coil unit. Pull disconnect line voltage as standard on all models. Single-Point Power Source Control Box - Control Box may be used with optional electric heat when single power supply is connected to multi−circuit electric heat.

2.02 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Warranty: Commencing on Date of Installation.

1. Compressors: 5 years (limited).
2. Integrated Modular Control: 3 years (limited).
3. Other System Components: 1 year (limited).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: The Contractor shall be responsible for inspecting equipment prior to installation.

3.02 INSTALLATION

A. Location: Install equipment as close as possible to the locations shown on the drawings. Equipment shall be installed according to applicable NFPA standards and the manufacturer's installation instructions.

B. Connections: Connections, flexible duct connections, and duct transitions shall be as shown on the drawings. Flexible conduit and wiring connections shall be used on the AHU if local codes permit. A flexible connection shall be used at the drain connection.

C. Mounting: Mount AHU in the location shown on the drawings mounted to wall with manufacturer's bracket using vibration isolators. Unit shall be mounted so as to provide access to hanger brackets and removable panels housing equipment and electrical connections. Piping shall not be run under the unit. Mounting shall provide for easy replacement of filters. Filters shall be in place prior to operation of the unit.

END OF SECTION

SECTION 16010
SUPPLEMENTARY GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED WORK

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.02 QUALITY ASSURANCE

A. Supervisory Qualifications: The electrical work on the project shall be under the direct supervision of a licensed Journeyman.

B. Qualifications of Installers:

1. For the actual fabrication, installation, and testing of the work of this section, uses only thoroughly trained and experienced personnel who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.
2. In acceptance or rejection of installed electrical systems, no allowance will be made for lack of skill on the part of the installers.

1.03 DRAWINGS

A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. An attempt to separate and completely define the work of Division 16000 has been made. Separate divisional drawings and specifications shall not relieve the Electrical Contractor from full compliance of the work of his trade indicated on any drawings or in any section of the specifications.

B. Examine all drawings and specifications carefully prior to submitting a bid. The Electrical Contractor will be required to install, and/or connect with appropriate services all items or equipment furnished by others as shown on any of the drawings without additional expense to the owner.

C. Architectural drawings take precedence over Mechanical or Electrical drawings with reference to building construction. Mechanical and Electrical drawings are diagrammatic, but shall be followed as closely as actual building construction and work of other trades permit.

D. Changes from drawings necessary to make the work of the electrical contractor conform to the building as constructed, or to fit work of other trades, or to comply with the rules of bodies having jurisdiction, shall be made by the Electrical Contractor at his own expense.

E. Field coordinate with other trades in ample time to build all chases and openings, set all sleeves, inserts and concealed materials and provide clearances that may be required.

F. The term, “provide” used in this Section of the specifications, shall include all labor, materials and equipment necessary to install any item or system indicated on either plans or specifications, including items called for, implied or normally part of the equipment or system. The finished installation shall be complete and fully operational before final acceptance.

G. The Architect or Engineer reserves the right to make any reasonable changes (approximately six feet) in the location of outlets, fixtures, switches, receptacles, or equipment prior to the rough-in of such without any additional cost to the Owner.

H. The Electrical Contractor is responsible for and shall pay for all access panels required in the architectural finishes or surfaces to provide access to the junction and pull boxes, ballasts, terminal cabinets or other devices provided and located by the Electrical Contractor. The access panel shall be installed by the trade constructing the base to which the access panel will be installed.

I. The Electrical Contractor is responsible for design, fabrication and erection of all supplementary structural framing required for attachment of hangers or other devices to support electrical equipment.

1. Framing members shall be designed for their actual loads, with allowable stresses set forth in AISC specifications and the AISC code, without excessive deflection and with consideration for rigidity under vibration. Supplementary framing, including design loads, member size and location shall be clearly shown on shop drawings for construction of supplementary framing.
2. No cutting or drilling of holes in structural member will be permitted, except where written permission has been obtained from the Architect.

1.04 EXPLANATION TO BIDDERS

A. No oral explanations in regard to the meaning of drawings and specifications will be made and no oral instructions will be given before the award of the contract. Discrepancies, omissions or doubts, as to the meaning of drawings and specifications, should be communicated in writing to the Engineer for interpretation. Bidders should act promptly and allow sufficient time for a reply to reach them before the submission of their bids. Any interpretation made by the Engineer will be in the form of an addendum to the specifications, which will be forwarded to all bidders. Receipt of the addendum shall be acknowledged by the bidder on his bid form.

1.05 BID REQUIREMENTS

A. Before submitting his proposal, the bidder is required to visit the site of the proposed work and familiarize himself with the nature and extent of the work and any local conditions that may, in any manner, affect the work to be done or the equipment, materials and labor required, He is also required to carefully examine the plans and specifications and to inform himself thoroughly regarding any and all conditions and requirements that may, in any manner, affect the work to be performed under the contract. Ignorance on the part of the Contractor will in no way relieve him of the obligations and responsibilities assumed under the contract.

B. In assembling his bid, the Contractor shall assemble a price based on these specifications and drawings as shown, and with all materials and equipment exactly as specified. This figure shall be known as the "Base Bid". All prices must have this base bid clearly stated to be considered. Alternate equipment may be quoted as an "add" or "deduct" item from the base bid in accordance with the specifications on substitutions.

C. If asked, the Contractors bidding on this project shall show evidence of having recently completed a similar job of like size and complexity. If the low bid contractor does not have sufficient financial resource, skilled labor, technical competence, or experience, he shall be not awarded the contract.

1.06 SUBSTITUTIONS

A. Each bidder represents that his bid is based upon the materials and equipment described in this Division of the specifications.

1. No substitutions will be considered unless a written request has been submitted to the Architect for approval twenty days prior to receipt of bids. Substitutions requested after that date will receive no consideration. Submittal shall include the name of the materials or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect to determine that the equipment meets all specifications and requirements. If the Architect approves any proposed substitutions, such approval will be set forth in writing.
2. Substituted equipment with all accessories installed or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense and Contractor shall so state in his written request for substitution.
3. Approved equal manufacturers or products may be provided elsewhere in these specifications and drawings. These are manufacturers or items which are known to be functionally equivalent to basis of design manufacturers and equipment. These alternatives are provided to produce a competitive bidding yielding a better value for the consumer. These items may and often do vary in specific characteristics, connections, and required services. The contractor remains liable and responsible for all coordination of other related systems, equipment, services, etc. There are a number of possible ramifications from utilizing other than the design basis equipment outside of changes to connection sizes and styles. These changes will need to be performed by the electrical and other contractors or they will need to contract with the engineer(s) of record to provide new coordinated drawings. All of these associated costs for utilizing equipment not selected on drawings as basis of design are to be borne by the contractor.

1.07 BID ALLOWANCES

A. Provide allowances in Electrical subcontract bid as may be directed to provide and install the quantity of fixtures of type noted in the luminaire schedule at the unit material cost indicated, or for other items requested.

1.08 SUBMITTALS

A. Submit items for this Division as follows:

1. Submit all Division 16000 submittals per section at one time and in one integral group. Piece-by-piece submission of individual items will not be acceptable. The Architect/Engineer may check the contents of each submittal set upon initial delivery and if not complete as set forth herein, submittal sets may be returned to the Contractor without review and may not be accepted until made complete.
2. Any delays arising directly or indirectly from deliverance of submittals in a timely manner shall be the Contractor's responsibility. Allow ten (10) working days from date of receipt for Architect/Engineer's review.

B. Submittal items shall include materials, apparatus and equipment as indicated under each Section of this Division and in compliance with the General Conditions.

C. Shop drawings shall include sufficient information to indicate compliance with specifications. Data shall include illustrations, catalog sheets, drawings and certifications. Each sheet shall show the manufacturer's name or trademark.

D. At the time of each submission, the Contractor shall call the Architect/Engineer's attention to any deviations from the Contract Documents and shall plainly mark the deviations on the shop drawings.

E. Manufacturer's Names and Catalog Numbers: In some instances, specific references have been made to one or more manufacturers' name and catalog numbers. It should be noted that such use does not indicate that the material and equipment specified is necessarily an "off the shelf" item. Variances may be due to the requirement of a desired finish, material or other modification. The Electrical Contractor shall ascertain that such modifications are fully considered.

F. Submittal cover sheet shall bear the stamp of the General Contractor indicating the review of the submittal contents to meet the intent of the construction documents.

1.09 FAMILIARITY WITH LAWS AND CODES

A. The bidder is assumed to be familiar with all Federal, State and Local laws, ordinances, rules and regulations that in any manner affect the work. Ignorance on the part of the bidder will in no way relieve the bidder from responsibility to meet these requirements.

1.10 ORDINANCES AND REGULATIONS

A. All work shall conform with all Federal, State and Local laws, ordinances or regulations governing the installation of the specified equipment. If the work as laid out, indicated or specified is contrary to or conflicts with local laws, ordinances or regulations, the Contractor shall report these conflicts to the Architect/Engineer before submitting a bid. The Architect/Engineer will then issue instructions to all bidders to clarify the conflict.

B. If the Contractor fails to notify the Architect/Engineer of conflicts or omissions as noted above, all changes required to comply with local ordinances and regulations shall be made without additional expense to the Owner.

1.11 PERMITS AND FEES

A. The Electrical Contractor shall obtain all necessary permits and inspections required for the electrical portion of the work and shall pay all charges incidental thereto.

B. The Electrical Contractor shall deliver to the Architect/Engineer all certificates of inspection issued by Authorities Having Jurisdiction

1.12 CODES AND INSPECTIONS

A. The installation shall comply with all laws applicable to the electrical installations, which are enforced by the authority having jurisdiction. The codes applicable to this project are shown on the architectural documents.

B. In any specific case where different sections of any aforementioned codes or these plans and specifications specify different materials, methods of construction or other requirements, the most restrictive shall govern. In the case of any conflict between a general provision and a special provision, the special provision shall govern.

C. All materials shall be listed by a nationally recognized testing laboratory, as conforming to its standards, where such a standard has been established for the particular type of material in question.

D. Where Contract Document requirements are in excess of code requirements and are permitted under the code, the Contract Documents will govern.

1.13 SINGULAR AND PLURAL REFERENCES

A. Singular references in specifications shall not be construed as requiring one (1) device if multiple devices are indicated on the drawings.

1.14 MATERIALS

A. Materials and equipment shall be new and in good condition. The commercially standard items of equipment and the specific names mentioned herein are intended to fix the standards of quality and performance necessary for the proper functioning of the electrical work.

B. Since manufacturing methods vary, reasonable minor equipment variations are expected. However, performance and material requirements for the specified equipment are the minimum acceptable standards. The Architect/Engineer retains the right to judge equality of equipment that deviates from the specifications.

1.15 IDENTIFICATION OF EQUIPMENT

A. All electrical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic with letters at least 3/8" high.

B. Nameplate designations shall correspond to the identifications on the “record drawings”.

C. Refer also to Specification Sections 16160 for additional nameplate requirements.

1.16 OPERATING AND MAINTENANCE BOOKS

A. The Electrical Contractor shall provide the Owner’s Representative with operating instructions and maintenance data books for all equipment and materials furnished under this division. Provide Engineer with receipt of transfer to Owner.

B. The Electrical Contractor shall submit to the Architect/Engineer, final competition before final inspection, an electronic copy of operating and maintenance data in a single PDF file for review. All data shall be assembled and completely indexed into one volume and shall identify the size, model, and features indicated for each item.

C. The following information shall be included where applicable:

1. Identifying name and mark number
2. Locations (Where several similar items are used, provide a list.)
3. Complete nameplate data
4. Certified record drawings and shop drawings

5. Parts lists
6. Wiring diagrams
7. Manufacturers' operating and maintenance instructions, with all non-applicable information deleted.
8. Equipment warranties.

1.17 DATE OF COMPLETION AND TESTING OF MECHANICAL/ELECTRICAL SYSTEMS

A. The date for all the final acceptance tests by the Engineer shall be sufficiently in advance of the contract completion date to permit the execution of any adjustments and/or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment. Any such modifications shall be completed within the number of days allotted for completion of the contract. Re-tests shall not relieve the Contractor for this Division of his contract completion date responsibility.

1.18 GUARANTEE AND SERVICE

A. In addition to the guarantee of equipment by the manufacturer of each piece of equipment specified herein, the Electrical Contractor shall also guarantee such equipment and shall be held for a period of one (1) year from final acceptance test for necessary adjustments and/or replacements of all defective equipment, and materials and workmanship without expense to the Owner.

B. The Contractor shall furnish maintenance and service for one (1) year from final acceptance of the contract for all portions of the system. Such service for the one year period includes the following:

1. Necessary adjustment and/or replacement of all defective equipment and materials furnished.

C. Service and replacement of light bulbs shall be limited to thirty days after final acceptance of the job.

D. Upon expiration of each of these limits noted herein, the maintenance, including labor and material costs, shall be at the Owner's expense.

1.19 ACCEPTANCE

A. As a precedent to requesting a final inspection and release of retained monies, the Electrical Contractor shall:

1. Complete all work required under the electrical section of the specifications.
2. Submit four (4) certified copies of final test data to the Architect/Engineer.
3. Furnish a complete set of "as built" reproducible tracings of the Contractor's work to the Architect/Engineer.
4. Submit four (4) copies of operating and maintenance books to the Architect/ Engineer.
5. Provide resolution to all issues noted on Engineers' Field Reports and Final Punch lists.
6. Provide all copies of certificates of inspection issued by Authorities Having Jurisdiction.

END OF SECTION

SECTION 16142
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section. Section 16010, Supplementary Electrical Conditions, shall apply to the work of this section.

B. This section is a Division-16 Basic Electrical Materials and Methods section, and is part of each Division-15 and –16 section making reference to electrical connections for equipment specified herein.

1.02 DESCRIPTION OF WORK

A. The Division 16 Contractor shall provide for final electrical connections to all electrically powered equipment furnished by others, shown on drawings as part of the work. Final electrical connections are hereby defined to include raceways, conductors, and termination materials required for providing electrical power and equipment ground to equipment furnished under this and other divisions.

B. Refer to Division 15 sections for mechanical equipment and control system wiring and all circuiting less than 120 volt alternating current.

C. Refer to Specification Section 11400 incorporated by reference only. Where electrical connections to these systems and/or equipment are shown on the construction documents, such work shall be included in the scope of work and coordinated with installation manual. Electrical contractor shall not be responsible for installing any owner furnished equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Raceways

1. Products shall comply with Division-16 basic electrical materials and methods Section 16110. Provide metal raceways and fittings of types grades, sizes and weights indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC and manufacturer's requirements for raceways.

B. Conductors

1. Provide conductors and connectors complying with Division-16 basic electrical materials and methods Section 16120.

C. Connectors and Terminals

1. Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications. Where receptacles or

connectors are required, coordinate to mate with device provided or equipment supplied.

D. Electrical Connection Accessories

1. Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

E. Disconnecting means:

1. All electrical equipment shall contain a disconnecting means. All disconnecting means not furnished integral with equipment shall be provided and installed by the electrical contractor regardless if they are indicated on the drawings. Comply with Section 16170 requirements.

F. Motor controllers.

1. All motors shall contain a controller. Where disconnecting means cannot serve as the controller such controllers shall be provided and installed by others. Make all electrical connections to/from the controller.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review shop drawings and submittal data with regards to area and conditions under which electrical connections for equipment are to be provided. Manufacturer's installation recommendations are to be reviewed prior to rough-in installation. Where clearances provided do not meet code or installation requirements, written notification shall be provided to the Architect.

B. The electrical contractor shall be responsible for obtaining the booklet for all Owner furnished equipment. Ignorance on the part of the contractor shall in no way relieve the contractor from responsibility to meet requirements of equipment manufacturer’s.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Provide electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting though tapes which will remain on conductors. Ringing of copper conductors or cutting of strands is not acceptable.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torqueing tools.

D. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.

E. Provide identification for each disconnect for each piece of equipment served which indicates its voltage, source, and identification in accordance with Specification Section 16170 whether or not disconnect is provided by Owner.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirements.

B. Electrical contractor shall be required to identify equipment controllers or disconnects regardless if provided by electrical contractor or others.

END OF SECTION

SECTION 16414
DISCONNECT SWITCHES - GENERAL DUTY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Switches shall be furnished and installed at locations as shown on the drawings. Switches shall be of the type approved, indicated and specified herein.

1.02 REFERENCES

A. Switches shall be manufactured in accordance with the following standards:

1. UL 98 - Enclosed and Dead Front Switches
2. NEMA KS 1 - Enclosed Switches
3. NEMA 250 - Enclosures for Electrical Equipment

1.03 SERVICE ENTRANCE

A. Switches identified for use as service equipment are to be labeled for this application.

1.04 DRAWINGS

A. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Switches shall be manufactured by Square D Company or approved equal.

2.02 SWITCH INTERIOR

A. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

B. Lugs shall be UL Listed for 75° C conductors, aluminum or copper.

C. All current carrying parts shall be plated to resist corrosion.

2.03 SWITCH MECHANISM

A. The switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

B. The operating handle shall be an integral part of the box, not the cover.

C. Provisions shall be provided for padlocking the switch in the OFF position.

2.04 SWITCH ENCLOSURES

A. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1) or gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galv-annealed steel (Type 3R).

B. Tangential knockouts shall be provided to facilitate ease of conduit entry on switches through 200 ampere.

C. Enclosures for Type 3R switches through 200 ampere shall have provisions for interchangeable bolt-on hubs in the top endwall. Hubs shall be Square D B-Type hubs sized as indicated on the plans.

2.05 SWITCH RATINGS

A. Switches shall be horsepower rated for 240Vac as indicated on the plans.

B. The UL Listed short circuit rating shall be 10,000 rms symmetrical amperes when used with or protected by class H or K fuses (30-600 amperes) or 100,000 rms symmetrical amperes when used with or protected by Class R fuses (30-600 ampere switches employing appropriate fuse rejection scheme).

PART 3 – EXECUTION - NOT USED

END OF SECTION

SECTION 16441
LOAD CENTERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

B. Refer to Supplementary Conditions.

1.02 DESCRIPTION OF WORK

A. Load centers to be furnished and installed at locations as shown on the drawings. Load centers shall be of the type approved, indicated, and specified herein.

1.03 SUBMITTALS

A. Suppliers shall provide data on arrangement of circuit breakers in each load center. Circuit breakers to be utilized, bus ratings and materials, dimensional drawings of enclosures with circuit breaker mounting provisions.

1.04 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

B. NEMA PB 1 - Panelboards

C. NEMA PB 1.1 - General Instruction for Safe Installation, Operation and Maintenance Of Panelboards Rated 600 Volts Or Less

D. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

E. Federal Specifications W-C-375B - Molded Case Circuit Breakers

F. Federal Specifications W-P115C - Type 1 Class 2 Load Center.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Siemens.

B. Schneider Electric; Square D Products.

2.02 ENCLOSURES

A. NEMA PB1: Type 1 as shown on the drawings.

B. Enclosure shall be fabricated of cold rolled steel for NEMA 1 and galvanized and annealed steel or equivalent rust-resistant steel for location of installation.

C. Indoor Type l enclosures shall have a flush front, with finish of gray baked enamel.

D. A laminated directory label shall be provided with circuits identified via typeset as indicated on the schedule.

E. Mounting shall be as indicated on the drawings.

2.03 INTERIORS

A. NEMA PB1: Type 1 as shown on the drawings.

B. Bus bar connections to the branch circuit breakers shall be the distributed phase type and shall accept plug-on circuit breakers.

C. Short Circuit Current Ratings: 65,000 ampere series ratings shall be provided per the schedule. This rating shall be established by manufacturer testing of a representative load center with main and branch circuit breakers installed.

D. Provide with equipment ground bar with lugs bonded to enclosure.

2.04 SHORT CIRCUIT CURRENT RATINGS

A. NEMA AB 1 Federal Specification W-C-375

B. Circuit breakers shall be Square D type QO plug-on thermal magnetic trip, with an integral crossbar to ensure simultaneous opening of all poles in multi-pole circuit breakers.

C. Circuit breakers shall have an over-center, trip free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication.

D. Handles shall have ON, OFF, and "Tripped" positions. In addition, trip indication shall include a VISI-TRIP indicator appearing in the window of the circuit breaker case (through 125 amperes).

E. Circuit breakers shall be UL Listed in accordance with UL standard 489 with current ratings as noted on the plans. Interrupting ratings shall be selected to provide the required load center short circuit current rating.

F. Circuit breakers intended for use with air conditioning, heating, and refrigeration equipment having motor group combinations and marked as such shall have the HACR marking.

G. The following special application circuit breakers or circuit breaker accessories shall be provided where shown on the drawings:

1. Circuit breakers with ARC fault interrupting capabilities.
2. Circuit breakers with GFIC interrupting capabilities.
3. Circuit breakers with ARC & GFIC interrupting capabilities.
4. Circuit breakers with lockable capabilities.

PART 3 - EXECUTION

3.01 CIRCUIT BREAKERS

A. Circuit breakers shall be rated for the available fault current at the line lugs or main circuit breaker.

B. Circuit breakers shall not be “twin” or “piggyback” mounted in space provisions.

C. All circuit breakers shall be UL labeled and shall be thermal magnetic or electronic solid state, molded case type, quick-make and quick-break both on manual and on automatic operation and shall be of the plug-on type.

D. All multi-pole breakers shall be internal common trip. The breakers furnished shall be determined by the specifications, the ampacity and poles, as scheduled or as indicated, and by the minimum UL labeled RMS symmetrical amperes interrupting capacity at circuit voltage, as indicated by the schedules.

E. Breakers shall not be rated for less than 10,000 RMS symmetrical amperes. NEMA ratings shall not be acceptable in lieu of UL ratings.

F. Breakers shall be labeled as required by the NEC. All circuit breakers shall be rated for available symmetrical fault at its line side terminals. Series rates circuit breakers shall/shall not be acceptable.

END OF SECTION

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

B. Refer to Supplementary Conditions.

1.02 DESCRIPTION OF WORK

A. The work included under this Section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary to insure that the electrical service and electrical systems conform with the requirements of Article 250 of the NEC and as specified hereinafter.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The products specified in Section 16120 apply to the work specified in this Section.

B. Ground rods shall be a minimum of 5/8″ x 10′-0″ Copper-clad ground rods.

C. Ground clamps shall be UL approved for the application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The following systems and/or equipment shall be grounded in accordance with the rules of the National Electrical Code, the local code and as hereinafter specified.

1. Building Power System
2. Raceway and Conduit Systems
3. Lighting Fixtures
4. Non-current Carrying Metal Parts of all Motors, Panels and Other Electrically Operated Equipment.
5. Telephone System
6. Fire Alarm System
7. Each above Ground Gas Piping System Upstream from the Equipment Shutoff Valve.

B. The service equipment shall be bonded ahead of the main water service meter and grounded to installed ground rods using bare copper wire in steel conduit bonded at both ends. The wire shall be sized in accordance with Article 250-94 of the NEC. Copper-clad ground rods shall be driven to a depth sufficient to provide a grounding

electrode of 25 ohms maximum resistance to ground. If the resistance is greater than 25 ohms, additional ground rods shall be installed and bonded to the first electrode.

C. Made electrodes shall consist of (3) copper ground rods. The rods shall be installed such that at least 10'-0" of length is in contact with the soil. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding wire attachment are protected against physical damage.

D. All metallic conduits entering the building service panel shall be bonded together and to the system service ground. Metallic conduit systems shall be electrically continuous throughout.

E. The system neutral conductor shall be identified throughout and shall be grounded at the building service only.

F. An equipment grounding wire sized as per NEC shall be installed inside all conduit, and shall have green insulation.

G. All grounding electrode connections shall be accessible for periodic inspection and testing.

H. Isolated ground systems shall have a separate ground wire installed in the conduit which is run to the building service ground with no other interconnections between normal ground and isolated ground. Isolated ground wires shall be sized in accordance with the equipment served and shall be identified by a colored stripe on the green insulation.

1. Isolated ground systems shall have a separate ground wire installed in the conduit which is run to the building service ground with no other interconnections between normal ground and isolated ground. Isolated ground wires shall be sized in accordance with the equipment served and shall be identified by a colored stripe on the green insulation.

I. Grounding of all system equipment including, fire alarm, telephone and cable T.V. shall include bonding of the required system grounding electrode with the building service main grounding electrode at the service entrance. Minimum size bonding conductor shall be #6 AWG copper. Bonding together of all separate electrodes shall be permitted.

END OF SECTION