BIDDING REQUIREMENTS, CONTRACT DOCUMENTS

and

TECHNICAL SPECIFICATIONS

FOR THE CONSTRUCTION OF

MUNICIPAL PARKING GARAGE REPAIRS PROJECT - PHASE I
COLLEGE STREET GARAGE / MARKETPLACE GARAGE

for the

City of Burlington, VT
Department of Public Works
Chittenden County

July 2015

Prepared by:

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STATE OF VERMONT
JON A. OLIN
No. 8262
STRUCTURAL I
LICENSED
PROFESSIONAL ENGINEER

07/07/15

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A. City of Burlington – Pre-Qualification of Construction Contractor Application

SECTION 00030
ADVERTISEMENT FOR BIDS

Municipal Parking Garage Repairs Project – Phase I
College Street Garage / Marketplace Garage
City of Burlington, Vermont

ARTICLE 1 - ADVERTISEMENT

1.01 BID OPENING

A. Sealed bids for construction of Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage will be received at the office of the City of Burlington / Department of Public Works at 645 Pine Street, Suite A, Burlington, VT 05401 **until 3:00 p.m. local time on Wednesday, July 29, 2015.** Bids received after this time will not be accepted. Bids will be opened and publicly read aloud immediately after the specified closing time.

1.02 PROJECT DESCRIPTION

A. OWNER: City of Burlington

B. ENGINEER: Hoyle, Tanner & Associates, Inc.

C. Type of Construction: The work to be completed under this contract is the first of 2 phases of repairs at the City of Burlington municipal parking garages. Repairs shall include concrete crack and spall repair, sealants, sealers, coatings, drainage systems, electrical system repairs, storefront systems, and elevator retrofit.

D. The Engineer's estimate for the work is between $1,000,000 and $1,500,000.

E. The anticipated project schedule is to start construction about **August 17, 2015** and complete construction about **November 24, 2015**.

F. All bidders on this project shall be prequalified by the City of Burlington. All subconsultants performing work for this project equal to or greater than $7,500 shall be prequalified by the City of Burlington.

City of Burlington prequalification shall be submitted by interested Bidders a minimum of 5 days before the Bid Due Date unless they are already qualified with the City of Burlington under a prior project. A Prequalification Application is included with these Bid Documents. Please contact the project manager for questions.

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1.03 PROCUREMENT OF DOCUMENTS

A. Bidding Documents may be examined at the following locations:

City of Burlington / Department of Public Works
645 Pine Street, Suite A
Burlington, VT 05401

Works in Progress
21 Farrell St.
South Burlington, VT 05403

B. Copies of complete Bidding Documents may be obtained after **July 7, 2015** from:

Blueprints Etc.
20 Farrell St
South Burlington, VT
802-865-4503

C. Bidder shall submit a bid using original forms authorized by and obtained from this package of Contract Documents. (See Instructions to Bidders)

1.04 PRE-BID CONFERENCE

A. A **mandatory** pre-bid conference is scheduled for this project on **Thursday, July 16, 2015 at 10:00 am.** Prospective bidders shall meet at the City of Burlington, Department of Public Works, 645 Pine Street, Suite A, Burlington, VT 05401.

1.05 BID SECURITY AND BOND

A. Bidders will be required to furnish bid security in accordance with the Instructions to Bidders in the form of a Bid Bond or certified check in the amount of 5% of the total bid. The successful bidder will be required to furnish a Performance Bond and a Payment Bond each in the amount of 100% of the Contract Price.

B. The Owner reserves the right to reject any or all bids, to accept any bid, to waive any informality or irregularity on bids received.

1.06 OWNER'S REPRESENTATIVE

To be determined.

END OF SECTION

SECTION 00100
INSTRUCTIONS TO BIDDERS
(EJCDC Form C-200, Modified)

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:

A. *Issuing Office*--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement for Bids may be obtained from the Issuing Office.

2.02 Complete sets of Bidding Documents, obtained from the ENGINEER must be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents. Failure of Bidder to obtain authorized bidding documents from the ENGINEER may be cause for rejection of a bid.

2.03 OWNER and ENGINEER in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after the bid opening and within five days of OWNER's request Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below.

A. Latest Financial Statement

B. Two (2) Bank References

C. List of Relevant Completed Projects

D. Client References

E. Present Project Commitments, with schedules for completion

F. List of Proposed Subcontractors and the trades they will provide

G. Contractors shall also be pre-qualified with the City of Burlington, applications for pre-qualification are included in the appendix documents and shall be submitted 5

working days prior to the bid opening.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 *Subsurface and Physical Conditions*

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.01.A will be made available by OWNER to any Bidder for review on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions has been identified and established in paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities, including OWNER, or others.

4.03 *Hazardous Environmental Condition*

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by OWNER to any Bidder for review on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.06 of the General Conditions has been identified and established in paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 4.06 of the General Conditions.

4.05 On request, OWNER may provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies, to the satisfaction of the OWNER. All costs for such examinations and coordination of such with OWNER are the sole responsibility of the Bidder.

4.06 Reference is made to Article 7 of the Standard General Conditions for the identification of the general nature of other work, if any, that is to be performed at the Site by OWNER or others (such as utilities and other prime contractors) that relates to the Work for which a Bid is to be submitted. On request, OWNER will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;

E. obtain and carefully study (or accept consequences of not doing so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including any specific means, methods,

techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. promptly give ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by ENGINEER is acceptable to Bidder; and

J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by ENGINEER are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A Mandatory pre-Bid conference will be held for this project as defined in the Advertisement for Bids. Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders are required to attend and participate in the conference. ENGINEER will transmit to all prospective Bidders of record such Addenda as ENGINEER considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

5.02 If a mandatory pre-bid conference is held, only bids from those bidders in attendance will be accepted by the owner.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by OWNER unless otherwise provided in the Bidding Documents. All additional lands and access thereto

required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by CONTRACTOR.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by ENGINEER as having received the Bidding Documents. Questions received less than **ten** days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by OWNER or ENGINEER.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to OWNER in an amount of **5%** of Bidder's maximum Bid price and in the form of a certified or bank check or a Bid Bond [on the unbound form provided] issued by a surety meeting the requirements of paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within **15** days after the Notice of Award, OWNER may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of **seven** days after the Effective Date of the Agreement or **60** days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom OWNER believes do not have a reasonable chance of receiving the award will be returned within **seven** days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-

equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to OWNER in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within **five** days after Bid opening, submit to OWNER a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by OWNER. If OWNER or ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, Individual, or entity, OWNER may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the Contract award.

12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which OWNER or ENGINEER makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to OWNER and ENGINEER subject to revocation of such acceptance after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.

12.03 Subcontractors performing work for a fee greater than or equal to $7,500 must be prequalified. Reference 1.02 F of the Advertisement for Bids for instructions.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents. A separate unbound copy of the Bid Form is included. Bidder shall submit a bid using the unbound original Bid Form provided. Failure of Bidder to use original forms authorized from the ENGINEER will be cause for rejection of a bid. Additional unbound copies may be obtained from the ENGINEER.

13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed. A Bid price shall be indicated for each Bid item, alternative, adjustment unit price item, and unit price item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which shall be filled in on the Bid form.

13.10 The address and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid form.

ARTICLE 14 - BASIS OF BID; EVALUATION OF BIDS

14.01 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in paragraph 11.02 of the General Conditions.

14.03 Familiarity with Laws, Ordinances and Regulations

A. By submitting a bid an entity certifies that it is familiar with all Federal, State and local laws, ordinances and regulations which affect in any way the materials, equipment, haul roads used in or upon the work, the conduct of the work, and the persons engaged or employed in the performance of the work to be performed pursuant to the contract.

B. By submitting a bid an entity certifies that it shall forthwith report in writing to the Municipality any provision in the plans, proposal, specifications or proposed contract that the bidder/contractor believes is in conflict with or inconsistent with any Federal, State or local law, ordinance, or regulation.

C. By submitting a bid a prospective Bidder certifies that if, during its investigation of the work in the process of preparing its bid, it discovers or encounters subsurface or latent physical conditions at a project site differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, it shall notify in writing the Municipality of the specific differing conditions immediately upon discovering or encountering the differing site conditions.

D. An entity further certifies that if it fails to notify the Municipality of any differing site conditions as described above, it shall waive any and all rights that it might have to additional compensation from the Municipality for additional work as a result of the differing site conditions and that it shall not bring a claim for additional compensation because of differing site conditions.

E. By submitting a bid a prospective bidder/contractor certifies that no claim or defense of ignorance or misunderstanding concerning Federal, State or local laws, ordinances and/or regulations will be employed by a bidder/contractor or considered by the Municipality in claims, litigation, alternative dispute resolution procedures, or other matters concerning the contract for which the bid is submitted.

F. By submitting a bid a prospective bidder/contractor certifies that it has read and understands the following local ordinances and will comply with their provisions and certify such compliance following notice of award:

i. Women's Economic Opportunity Program. As defined by SUBPART B - RELATED LAWS, CHAPTER 21, ARTICLE II – WOMEN IN CONSTRUCTION TRADES, Sections 21-50 through 21-55. For the projects where the total cost is fifty thousand dollars ($50,000.00) or more.

ii. Prequalification of Construction Contractors. As defined by SUBPART B - RELATED LAWS, CHAPTER 21, ARTICLE V - Prequalification of Construction Contractors, Sec. 21-67 through Sec. 21-78. For all projects where total project cost is one hundred thousand dollars ($100,000.00) or more.

iii. City Livable Wages Ordinance. As defined by SUBPART B - RELATED LAWS, CHAPTER 21, ARTICLE VI - LIVABLE WAGES, Sec. 21-80 through Sec. 21-87. For any contractor that has a service contract(s)with the City of Burlington where the total amount of the service contract or service contracts exceeds fifteen thousand dollars ($15,000.00) for any

twelve (12) month period, including any subcontractors of such contractor or vendor.

iv. City Outsourcing Ordinance. As defined by SUBPART B - RELATED LAWS, CHAPTER 21, ARTICLE VII - OUTSOURCING, Sec. 21-90 through Sec. 21-94. For any contract for services which involves any city funds and the total amount of the contract is fifty thousand dollars ($50,000.00) or more

v. City Union Deterrence Ordinance. As defined by SUBPART B - RELATED LAWS, CHAPTER 21, ARTICLE VIII – UNION DETERRENCE, Sec. 21-100 through Sec. 21-103. For Any contract for services which involves any City funds and the total amount of the contract is fifteen thousand dollars ($15,000.00) or more

G. By submitting a bid a prospective bidder/contractor certifies that it has read and understands the following local ordinances and will comply with the applicable requirements:

i. Erosion Prevention and Sediment Control Plan. As defined by CHAPTER 26 WASTEWATER, STORMWATER, AND POLLUTION CONTROL - ARTICLE III. STORMWATER AND EROSION CONTROL, Sec 96-160. Contractor shall be responsible for filing a Small Project Erosion Control Plan and maintaining practices identified in the approved plan.

ii. Excavations and Obstructions. As defined by Chapter 27 STREETS AND SIDEWALKS - ARTICLE II. EXCAVATIONS AND OBSTRUCTIONS, Sec 29-62. The Contactor shall be responsible to obtaining a no-charge permit for all locations identified in the Contract Documents where pavement and excavation is disturbed within the right-of-way.

ARTICLE 15 - SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid form is to be completed and submitted with the Bid security and other required documents.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title, the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED". A mailed Bid shall be addressed to the party as indicated in the Advertisement for Bids. Bids submitted by electronic means will not be accepted.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, may be made available, only to Bidders that have submitted a bid, and only after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid form, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 - AWARD OF CONTRACT

19.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. OWNER further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, not be responsible. OWNER may also reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder. Rejection for this reason is in the sole judgment of the OWNER, this is so even if a BIDDER is the low bidder. OWNER also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid form or prior to the Notice of Award.

19.04 In evaluating Bidders, OWNER will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 The award of this Contract will be for both the Marketplace and College Street Garages to one Bidder as defined in 19.07.

19.07 If the Contract is to be awarded, OWNER will award the Contract to the lowest responsive, qualified and responsible Bidder on the basis of the Base Bid.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNER's requirements as to performance and payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it shall be accompanied by such Bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When OWNER gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within **15** days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER. Within **ten** days thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

END OF SECTION

SECTION 00300
BID FORM
(EJCDC Form C-410, Modified)

PROJECT IDENTIFICATION: Muncipal Parking Garage Repairs Project - Phase I
College Street Garage / Marketplace Garage

CONTRACT IDENTIFICATION AND NUMBER: Muncipal Parking Garage Repairs Project - Phase I
Hoyle, Tanner Project No. 909044

ARTICLE 1 – BID RECIPIENT

1.01 This bid is submitted to: City of Burlington Department of Public Works
645 Pine Street, Suite A
Burlington, VT 05401

A. Please note that the Bid Form is to be delivered to the Burlington Department of Public Works at the time and location noted in Section 00030, Article 1.01 Bid Opening.

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for **60** days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of OWNER.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

I. Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to Bidder.

J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following prices:

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
011000.01	Mobilization/Demobilization, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
012000.01	Traffic Control, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
024119.01	Existing Concrete Removal, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	1,710		
024119.11	Flange Removal for New Drains, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	22		
024119.12	Concrete Testing, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	4		
024119.21	Pressure Washing, for the unit price per sqaure foot of: _____Dollars (words) and_____Cents.	SF	16,500		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
024119.41	Beam Protective Wrap, for the unit price per sqaure foot of: _____Dollars (words) and_____Cents.	SF	275		
030130.01	Route And Seal Concrete Crack, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	125		
030130.11	Double-tee Connector Patch Repair, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	600		
030130.21	Horizontal Concrete Patch Repair Type I, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	350		
030130.22	Horizontal Concrete Patch Repair Type II, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	50		
030130.31	Vertical Concrete Patch Repair Type I, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	55		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
033000.01	Cast-in-Place Concrete, for the unit price per cubic yard of: _____Dollars (words) and_____Cents.	CY	25		
033000.11	Level 2 Bearing Repair, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
033000.21	Reinforcing Steel, for the unit price per pound of: _____Dollars (words) and_____Cents.	LB	50		
042000.01	Brick Façade Repair, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	90		
042000.02	Coping Replacement, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	70		
058000.01	Steel Pipe Bollard - Refurbish, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	4		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
058000.21	Stainless Steel Drain Pipe Guard, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	2		
058010.01	Cast-Iron ADA Detectable Warning Devices, for the unit price per squar foot of: _____Dollars (words) and_____Cents.	SF	8		
071800.11	Waterproofing Membrane, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	5,800		
071900.01	Penetrating Sealer/Corrosion Inhibitor, for the unit price per gallon of: _____Dollars (words) and_____Cents.	GAL	1,300		
075300.01	Roof Repair CSG at Elevator Roof, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
079200.01	Joint Sealant for Double Tee Beams, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	5,700		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
079200.11	Joint Sealant for C.I.P. Concrete Repairs, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	1,200		
079200.21	Joint Sealant Patch at Bolt Locations, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	720		
081113.01	Interior Hollow Metal Doors & Frames, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	28		
084313.01	Store Front Repair - Roof Vestibule-CSG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
084313.02	Store Front Infill, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
084313.03	Store Front Door, for the unit price each sum of: _____Dollars (words) and_____Cents.	EA	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
099600.01	Painting Lobby & Stair Walls, Railings - CSG, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	11,275		
099600.02	Coating Exterior Concrete and Masonry, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	100		
099600.03	Coating Exterior Ferrous-Metal, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
101400.01	Signage, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	28		
101400.02	Paint Wayfinding # Striping Stair Tower-CSG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
101400.03	Paint Wayfinding # Striping Beams/ COLS-CSG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
220500.11	Demolition of Above Grade Piping 2-3 1/2", for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	8		
220500.12	Demolition of Above Grade Piping 4-6", for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	364		
220500.13	Demolition of Above Grade Parking Drain, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	15		
220500.14	Demolition of Slab On Grade Parking Drain, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
221006.11	New Above Grade Parking Drain 3-4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	24		
221006.12	New Above Grade Parking Trench Drain, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	5		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
221006.13	New Roof Drain 3", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
221006.14	New Slab on Grade Parking Drain 3-4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
221009.11	New Above Grade PVC Piping & Couplings 3", for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	8		
221009.12	New Above Grade PVC Piping & Couplings 4", for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	632		
221009.13	New Above Grade PVC Piping & Couplings 5", for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	47		
221009.14	PVC 1/4 Bend 3", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
221009.15	PVC 1/4 Bend 4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	23		
221009.16	PVC 1/4 Bend 6", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
221009.17	PVC 1/8 Bend 4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	22		
221009.18	PVC 1/8 Bend 6", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		
221009.19	PVC Comb. Wye 1/8th Bend 3", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	2		
221009.01	PVC Comb. Wye 1/8th Bend 4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	32		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
221009.02	PVC Comb. Wye 1/8th Bend 6", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	8		
221009.03	PVC Wye 4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	9		
221009.04	PVC Double Wye 4", for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
230500.11	Remove Existing 4" Abandoned Ductwork, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
260500.23	Demolition, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
260500.14	Beam Envelope Accomodation, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
260533.13	Raceway Painting, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	1,200		
260533.21	Junction Boxes, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	10		
260533.22	Raceway, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	200		
261519.22	Conductors, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	200		
265210.23	Signage Lighting, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		
329119.11	Landscaping, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – COLLEGE STREET GARAGE

TOTAL CONTRACT PRICE COLLEGE STREET GARAGE BID:

_____Dollars
(words)

and_____Cents.

($_____)
(numbers)

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
011000.02	Mobilization/Demobilization, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
012000.02	Traffic Control, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
024119.02	Existing Concrete Removal, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	290		
024119.31	Spandrel Beam Removal / Reattachment, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
030130.02	Route and Seal Concrete Crack, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	230		
030130.22	Horizontal Concrete Patch Repair Type II, for the unit price per sqaure foot of: _____Dollars (words) and_____Cents.	SF	880		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
030130.42	Cathodic Protection, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	880		
033000.21	Reinforcing Steel, for the unit price per pound of: _____Dollars (words) and_____Cents.	LB	50		
058000.11	Stair Tread Reattachment/Tower - MPG, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	200		
071900.02	Penetrating Sealer/Corrosion Inhibitor, for the unit price per gallon of: _____Dollars (words) and_____Cents.	GAL	65		
076200.01	Flashings and Counter Flashings, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	75		
076200.02	Coping Repair, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	70		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
084413.01	Curtain Wall Repair - Lower Glass X2 - MPG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
088000.01	Glazing, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	100		
099600.04	Coating Interior Concrete Masonry Units, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	100		
099600.05	Coating Interior Metal Surface, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
099600.06	Coating Interior Ferrous-Metal, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
099600.07	Coating Interior Galvanized Metal, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
099600.08	Coating Epoxy Floor Coating, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	100		
099723.01	Epoxy Floor Coating & Base (EMR – ESHAFT), for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
140500.01	Elevator Tower / Machine Room Incidental Items (PH 1), for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
142400.01	Elevator Car Replacement - MPG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
220500.11	Existing Level 1 Cherry St. Trench Drain Demolition, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	8		
221009.11	New Level 1 Cherry St. Trench Drain, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
230500.11	Elevator Machine Room Mechanical and Plumbing Scope, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
260500.11	Data Cabling, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	250		
260500.12	Discoonnects, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
260500.13	Demolition, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
260500.15	New Control Relay, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
260500.16	HVAC Connections, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
260500.17	Elevator Circuit Reconnections, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	2		
260533.11	Junction Boxes, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
260533.12	Raceway, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	200		
260533.14	Repair to Existing Floor Junction Boxes, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	2		
261519.11	Conductors, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	200		
262726.11	Receptacles, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
262726.12	Equipment Switches, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	1		
265210.11	Wall and Ceiling Light Fixtures, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	6		
265210.12	Emergency Light Fixtures, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	2		
265210.13	Signage Lighting, for the unit price per each of: _____Dollars (words) and_____Cents.	EA	3		
323119.01	Ornamental Fencing - MPG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		
321123.01	Aggregate Base Course, for the unit price per cubic yard of: _____Dollars (words) and_____Cents.	CY	6		

NOT FOR CONSTRUCTION

BID SCHEDULE – MARKETPLACE GARAGE

ITEM NO.	ITEM DESCRIPTION AND UNIT PRICE BID WRITTEN IN WORDS	UNIT	ESTIMATED QUANTITY	UNIT PRICE DOLLARS CTS	TOTAL PRICE DOLLARS CTS
321313.01	Concrete Sidewalk, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	130		
321313.11	Cast-in-Place Concrete Curb, for the unit price per linear foot of: _____Dollars (words) and_____Cents.	LF	35		
321313.12	Cast-in-Place Concrete Pavement, for the unit price per square foot of: _____Dollars (words) and_____Cents.	SF	130		
323119.01	Ornamental Fencing & Gate - MPG, for the unit price per lump sum of: _____Dollars (words) and_____Cents.	LS	1		

TOTAL CONTRACT PRICE MARKETPLACE GARAGE BID:

_____Dollars
(words)

and_____Cents.

($_____)
(numbers)

NOT FOR CONSTRUCTION

TOTAL CONTRACT PRICE COLLEGE STREET GARAGE & MARKETPLACE GARAGE COMBINED BID:

_____Dollars
(words)

and_____Cents.

($_____)
(numbers)

Unit Prices have been computed in accordance with paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially completed and ready for final payment in accordance with paragraph 14.07.B of the General Conditions on or before the dates or within the Contract Times.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within contract times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid security in the form of _____.

B. List of Project References

B. List of Subcontractors

C. Contractors / Subcontractors performing the following work must have a minimum of 3 representative projects and references, to be provided within 5 days after bid opening upon request from the OWNER. List Primary Contractor/Subcontractor identified for the following work on the lines below:

03 0130.11,21,22,23,31 – Concrete Repair _____

07 1800.11 – Waterproofing Membrane _____

07 1900.01,02 – Penetrating Sealer/Corrosion Inhibitor _____

07 9200.01 – Joint Sealant for Double Tee Beams _____

14 2400.01 – Elevator Car Replacement – MPG _____

NOT FOR CONSTRUCTION

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name (typed or printed):_____

By:_____(SEAL)
(Individual's signature)

Doing business as:_____

A Partnership

Partnership Name:_____(SEAL)

By:_____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed):_____

A Corporation

Corporation Name:_____(SEAL)
State of Incorporation:_____
Type (General Business, Professional, Service, Limited Liability):_____

By:_____
(Signature -- attach evidence of authority to sign)

Name (typed or printed):_____

Title:_____

(CORPORATE SEAL)

Attest_____
(Signature of Corporate Secretary)

Date of Qualification to do business in _____ is ____/_____/_____
State of Territory where project is Located.

A Joint Venture

NOT FOR CONSTRUCTION

Name of Joint Venturer:_____

First Joint Venturer Name:_____(SEAL)

By:_____
(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed):_____

Title:_____

Second Joint Venturer Name:_____(SEAL)

By:_____
(Signature of second joint venturer partner - attach evidence of authority to sign)

Name (typed or printed):_____
Title:_____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidders Business address:_____
_____
Phone No.:_____ FAX No.:_____

SUBMITTED on _____, 20___.

State Contractor License No. _____. (If applicable)

END OF SECTION

NOT FOR CONSTRUCTION

SECTION 00410
BID BOND
(EJCDC Form C-430)

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER (*Name and Address*):

_____
_____
_____

SURETY *(Name and Address of Principal Place of Business*):

_____
_____
_____

OWNER (*(Name and Address***):**

_____
_____
_____

BID

BID DUE DATE:_____

PROJECT (*Brief Description Including Location*):

_____
_____
_____

BOND

BOND NUMBER:_____

DATE:(*Not later than Bid Due Date*):_____

PENAL SUM:_____ _____

(Words) *(Figures)*

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the following pages hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER	SURETY
_____(Seal)	_____(Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By:_____	By:_____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest:_____	Attest:_____
Signature and Title	Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of the Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

   3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

   3.2 All bids are rejected by Owner, or

   3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by Owner and Bidder, provided that the time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notice required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of the Bond conflicts with any

applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer or proposal as applicable.

END OF SECTION

SECTION 00500
AGREEMENT
(EJCDC FORM C-520, Modified)

THIS AGREEMENT is by and between City of Burlington Department of Public Works

(hereinafter called OWNER) and _____

(hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 - WORK

1.01 CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

A. General parking garage repairs including concrete crack and spall repair, sealants, sealers, coatings, drainage systems, electrical system repairs, storefront systems, and elevator retrofit.

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

A. Muncipal Parking Garage Repairs Project - Phase I
College Street Garage / Marketplace Garage

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by Hoyle, Tanner & Associates, Inc., 125 College Street, 4th Floor, Burlington, VT 05401, who is hereinafter called ENGINEER and who is to act as OWNER's representative, assume all duties and responsibilities, and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Days to Achieve Substantial Completion and Final Payment*

A. The Work will be substantially completed within **89 days** after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within **99 days** after the date when the Contract Times commence to run.

B. It is anticipated that Notice to Proceed will be issued on August 11, 2015 with work at the site beginning on or after August 17, 2015.

4.03 *Liquidated Damages*

A. CONTRACTOR and OWNER recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER **$1500** for each day that expires after the time specified in paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER **$900** for each day that expires after the time specified in paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

5.01 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to paragraphs 5.01A below:

A. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in the Bid Schedule of the executed Bid Form.

TOTAL OF ALL UNIT PRICES_____ $_____(dollars)
(use words)

As provided in paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by ENGINEER as provided in paragraph 9.07 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment. The CONTRACTOR shall submit payment applications to the ENGINEER by the **7th** day of each month during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established in paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER may determine or OWNER may withhold, in accordance with paragraph 14.02 of the General Conditions:

   a. 90% of Work completed (with the balance being retainage). If the Work has been 50% completed as determined by ENGINEER, and if the character and progress of the Work have been satisfactory to OWNER and ENGINEER, OWNER, on recommendation of ENGINEER, may determine that as long as the character and progress of the Work remain satisfactory to them, there will be no additional retainage; and

   b. 90% of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. Upon Substantial Completion, OWNER shall pay an amount sufficient to increase total payments to CONTRACTOR to 95% of the Work completed, less such amounts as ENGINEER shall determine in accordance with paragraph 14.02.B.5 of the General Conditions and less 100% of ENGINEER's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.07.

ARTICLE 7 - INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at a rate of 5.0% per annum.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. CONTRACTOR has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work. The CONTRACTOR has submitted signed certifications of compliance with special laws including:
   i. Women's Economic Opportunity Program
   ii. Prequalification of Construction Contractors
   iii. City Livable Wages Ordinance
   iv. City Outsourcing Ordinance
   v. City Union Deterrence Ordinance

D. CONTRACTOR has carefully studied all: (1) reports of explorations and tests of subsurface conditions, if any, at or contiguous to the Site and all drawings of physical conditions, if any, in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Conditions, if any, at the Site which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.

E. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, including applying the specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and programs incident thereto.

F. CONTRACTOR does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. CONTRACTOR is aware of the general nature of work to be performed by OWNER

and others at the Site that relates to the Work as indicated in the Contract Documents.

H. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

I. CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents, and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 - ACCOUNTING RECORDS

9.01 Contractor shall check all materials, equipment, and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under this Agreement, and the accounting methods shall be satisfactory to Owner. Owner shall be afforded access to all Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner.

ARTICLE 10 - CONTRACT DOCUMENTS

10.01 *Contents*

A. The Contract Documents consist of the following:

1. Advertisement for Bids
2. Instructions to Bidders
3. Bid Form
4. Notice of Award
5. Agreement
6. Notice to Proceed
7. Standard General Conditions
8. Supplementary Conditions
9. Special Conditions
10. Example Performance And Payment Bond Forms
11. Example Application For Payment
12. Example Project Change Order Form
13. Certificate of Substantial Completion
14. VTRANS Work Zone Safety And Mobility Guidance Document
15. City Of Burlington Woman in Construction Ordinance
16. City Of Burlington Livable Wage Ordinance
17. City Of Burlington Ordinance Forms
18. City Of Burlington Pre-Qualification Of Construction Application
19. City Of Burlington Holidays
20. City of Burlington Erosion Prevention and Sediment Control

21. Division 1 – General Requirements
22. Technical Specifications
23. Drawings Titled: *Repair Plans for College Street Parking Garage – Phase 1* and *Repair Plans for Marketplace Garage – Phase 1*
24. Addenda (numbers ___ to ___, inclusive);
25. Exhibits to this Agreement (enumerated as follows):
    a. CONTRACTOR's Bid (pages _____ to _____, inclusive);
    b. Documentation submitted by CONTRACTOR prior to Notice of Award (pages ___ to ___, inclusive);
26. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Notice to Proceed (pages _____ to _____, inclusive).
    b. Work Change Directives.
    c. Change Order(s).

B. There are no Contract Documents other than those listed above in this Article 10.

C. The Contract Documents may only be amended, modified, or supplemented as provided in paragraph 3.04 of the General Conditions.

ARTICLE 11 - MISCELLANEOUS

11.01 *Terms*

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

11.02 *Assignment of Contract*

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

11.03 *Successors and Assigns*

A. OWNER and CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

11.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close

as possible to expressing the intention of the stricken provision.

11.05 *Other Provisions*

A. None.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in duplicate. One counterpart each has been delivered to OWNER and CONTRACTOR. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR or on their behalf.

This Agreement will be effective on _____, _____ (which is the Effective Date of the Agreement).

OWNER:

City of Burlington
Department of Public Works

By:_____

Title: _____

Address for giving notices:

City of Burlington /
Department of Public Works

645 Pine Street, Suite A,
Burlington, VT 05401

(If OWNER is a corporation, attach evidence of authority to sign. If OWNER is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of OWNER-CONTRACTOR Agreement.)

CONTRACTOR:

By:_____

Title: _____

Address for giving notices:

_____

_____

_____

License No._____
(Where applicable)

Agent for service of process:_____

_____

(If CONTRACTOR is a corporation or a partnership, attach evidence of authority to sign.)

END OF SECTION

SECTION 00610
PERFORMANCE BOND
(EJCDC Form C-610)

Any singular reference to the Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

City of Burlington / Department of Public Works
645 Pine Street, Suite A
Burlington, VT 05401

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the following pages hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Contract, which is incorporated herein by reference.

2. If the Contractor performs the Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

3. If there is no Owner Default, the Surety's obligation under this Bond shall arise after:

   3.1 Owner has notified Contractor and Surety, at its address described in Paragraph 10 below, that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Owner, the Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

   3.2 Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after the Contractor and the Surety have received notice as provided in Paragraph 3.1; and

   3.3 The Owner has agreed to pay the Balance of the Contract Price to:

      1. Surety in accordance with the terms of the Contract;

      2. Another Contractor selected pursuant to Paragraph 4.3 to perform the Contract.

4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at the Surety's expense take one of the following actions:

   4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Contract; or

   4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

   4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

   4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

      1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefore to the Owner; or

2. Deny liability in whole or in part and notify the Owner citing reasons therefore.

5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to Owner. If the Surety proceeds as provided in Paragraph 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:

   6.1 The responsibilities of Contractor for correction of defective Work and completion of the Contract;

   6.2 Additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

   6.3 Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

8. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner or Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Construction Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by the Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.

12.2 Construction Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

END OF SECTION

SECTION 00620
PAYMENT BOND
(EJCDC Form C-615)

Any singular reference to the Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

City of Burlington / Department of Public Works
645 Pine Street, Suite A
Burlington, VT 05401

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Bond Number:
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the following pages hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if the Contractor:

   2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

   2.2 Defends, indemnifies and holds harmless Owner from all claims, demands, liens or suits alleging non-payment by Contractor by any person or entity whose claim, demand, lien or suit is for payment for labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

   4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

   4.2 Claimants who do not have a direct contract with Contractor:

      1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied, or for whom the labor was done or performed: and

      2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor has indicated the claim will be paid directly or indirectly; and

      3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:

6.1 Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to the Owner, Claimants or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related Subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner or Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, Owner or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1 Claimant: An individual or entity having a direct contract with Contractor or with a first-tier subcontractor of Contractor, to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation

in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2 Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

END OF SECTION

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SECTION 00700

STANDARD
GENERAL CONDITIONS
OF THE
CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

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The Associated General Contractors of America

Knowledge for Creating and Sustaining the Built Environment

Construction Specifications Institute

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These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Nos. C-520 or C-525 (2002 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001) (2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800) (2002 Edition).

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*--The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*--The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*--The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*--A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*-- Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*--The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*--The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*--See Paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*--The individual or entity named as such in the Agreement.

20. *Field Order*--A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

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21. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

22. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

23. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*--The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*--A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*--The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*--Polychlorinated biphenyls.

31. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*--A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Related Entity* -- An officer, director, partner, employee, agent, consultant, or subcontractor.

37. *Resident Project Representative*--The authorized representative of Engineer who may be assigned to the Site or any part thereof.

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Schedule of Submittals*--A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

40. *Schedule of Values*--A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

41. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

42. *Site*--Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

43. *Specifications*--That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

44. *Subcontractor*--An individual or entity having a direct contract with Contractor or with any other

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Subcontractor for the performance of a part of the Work at the Site.

45. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

46. *Successful Bidder*--The Bidder submitting a responsive Bid to whom Owner makes an award.

47. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

48. *Supplier*--A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.

49. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

50. *Unit Price Work*--Work to be paid for on the basis of unit prices.

51. *Work*--The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

52. *Work Change Directive*--A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.

B. *Intent of Certain Terms or Adjectives*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered", "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents, or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or

c. has been damaged prior to Engineer's - recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

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1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review**:**

1. a preliminary Progress Schedule; indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

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1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of, their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless

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such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 ***Amending and Supplementing Contract Documents***

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 ***Reuse of Documents***

A. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing all of the Work under a direct or indirect contract with Contractor, shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or

2. reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.

B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 ***Electronic Data***

A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 ***Availability of Lands***

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 ***Subsurface and Physical Conditions***

A. *Reports and Drawings:* The Supplementary Conditions identify:

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1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. Possible Price and Times Adjustments

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

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arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 ***Underground Facilities***

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 ***Reference Points***

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 ***Hazardous Environmental Condition at Site***

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

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C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent

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must be accompanied by a certified copy of the agent's authority to act.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 ***Licensed Sureties and Insurers***

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 ***Certificates of Insurance***

A. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

5.04 ***Contractor's Liability Insurance***

A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insured (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been

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issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.

a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 ***Owner's Liability Insurance***

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 ***Property Insurance***

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, (other than caused by flood) and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

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E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 ***Waiver of Rights***

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 ***Receipt and Application of Insurance Proceeds***

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order .

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 ***Acceptance of Bonds and Insurance; Option to Replace***

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other

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party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 ***Partial Utilization, Acknowledgment of Property Insurer***

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 ***Supervision and Superintendence***

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 ***Labor; Working Hours***

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 ***Services, Materials, and Equipment***

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 ***Progress Schedule***

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 ***Substitutes and "Or-Equals"***

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to

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establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole,

3) it has a proven record of performance and availability of responsive service; and

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times, and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;

b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified , and

b) available engineering, sales, maintenance, repair, and replacement services;

4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item,

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including costs of redesign and claims of other contractors affected by any resulting change,

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued . No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity, nor

2. shall anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or

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Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer,, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 ***Patent Fees and Royalties***

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 ***Permits***

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 ***Laws and Regulations***

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 ***Taxes***

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 ***Use of Site and Other Areas***

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor

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shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

D. Contractor’s duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

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A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 ***Hazard Communication Programs***

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 ***Emergencies***

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 ***Shop Drawings and Samples***

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. Shop Drawings

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:* Contractor shall also submit Samples to Engineer for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals.

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Submittal Procedures

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and

d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawing's or Sample Submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by

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the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such

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employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 - OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and shall properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that

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render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 ***Coordination***

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 ***Legal Relationships***

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.

C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 ***Communications to Contractor***

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 ***Replacement of Engineer***

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 ***Furnish Data***

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 ***Pay When Due***

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 ***Lands and Easements; Reports and Tests***

A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 ***Insurance***

A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 ***Change Orders***

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 ***Inspections, Tests, and Approvals***

A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 ***Limitations on Owner's Responsibilities***

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 ***Undisclosed Hazardous Environmental Condition***

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

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8.11 ***Evidence of Financial Arrangements***

A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 ***Owner's Representative***

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

9.02 ***Visits to Site***

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 ***Project Representative***

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 ***Authorized Variations in Work***

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment , a Claim may be made therefor as provided in Paragraph 10.05.

9.05 ***Rejecting Defective Work***

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 ***Shop Drawings, Change Orders and Payments***

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

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9.07 ***Determinations for Unit Price Work***

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 ***Decisions on Requirements of Contract Documents and Acceptability of Work***

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 ***Limitations on Engineer's Authority and Responsibilities***

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to, the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 ***Authorized Changes in the Work***

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 ***Unauthorized Changes in the Work***

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times

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with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 ***Execution of Change Orders***

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 ***Notification to Surety***

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any bond to be given to a surety, the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 ***Claims***

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim, shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part,

2. approve the Claim, or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 ***Cost of the Work***

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined

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on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to Engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

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h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expresses, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A and 11.01.B.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 ***Allowances***

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation , overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. Contingency Allowance

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 ***Unit Price Work***

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

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C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

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12.03 ***Delays***

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times , or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 ***Notice of Defects***

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 ***Access to Work***

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 ***Tests and Inspections***

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be

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incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 ***Uncovering Work***

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 ***Owner May Stop the Work***

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 ***Correction or Removal of Defective Work***

A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 ***Correction Period***

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or

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repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications .

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 ***Acceptance of Defective Work***

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 ***Owner May Correct Defective Work***

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 ***Schedule of Values***

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

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14.02 ***Progress Payments***

A. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations on the Site of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

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a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 ***Contractor's Warranty of Title***

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 ***Substantial Completion***

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, , Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's

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aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 ***Partial Utilization***

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 ***Final Inspection***

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 ***Final Payment***

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will,

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within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and , will be paid by Owner to Contractor.

14.08 ***Final Completion Delayed***

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 ***Waiver of Claims***

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 ***Owner May Suspend Work***

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 ***Owner May Terminate for Cause***

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and

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3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 ***Owner May Terminate For Convenience***

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 ***Contractor May Stop Work or Terminate***

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 ***Methods and Procedures***

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for

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mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 - MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00800
SUPPLEMENTARY CONDITIONS
(EJCDC Form C-800, Modified)

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

SC-2.02.A Amend the first sentence of paragraph 2.02.A to read as follows:

OWNER shall furnish to CONTRACTOR up to five (5) copies of the Contract Documents.

SC-2.03.A Delete paragraph 2.03A in its entirety and replace with the following:

A. The contract times will commence to run on the day indicated in the Notice to Proceed. In no event will the Contract Times commence to run later than the **60th** day after the date of the bid opening.

SC-2.06.A Amend the third line of paragraph 2.06.A to read as follows:

"others as appropriate MAY be held to establish a working"

SC-3.06.B Delete the last sentence of paragraph 3.06 B in its entirety.

SC-4.02 Add the following new paragraph(s) immediately after paragraph 4.02.B:

C. In the preparation of Drawings and Specifications, ENGINEER or ENGINEER's Consultants relied upon the following reports of explorations and tests of subsurface conditions at the Site or drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the Site:

1. None.

SC-4.06 Add the following new paragraph(s) immediately after paragraph 4.06.I:

J. In the preparation of Drawings and Specifications, ENGINEER or ENGINEER's Consultants relied upon the following reports of explorations and tests of hazardous environmental conditions at the Site or drawings of physical conditions in or relating to existing surface and subsurface (except Underground Facilities) which are at or contiguous to the Site:

1. None.

SC-5.04B Delete paragraph 5.04.B.5 in its entirety.

SC-5.04 Add the following paragraph immediately after paragraph 5.04.B:

C. The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Worker's Compensation, and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions:

1. Worker's Compensation, and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions:

a. State: With respect to all operations performed, the Contractor shall carry Workers Compensation Insurance in accordance with the laws of the State of Vermont. The Contractor shall also ensure that all subcontractors carry Workers Compensation Insurance for all Work performed by them.

b. Employer's Liability $ 500,000 each accident
$ 100,000 each employee – disease
$ 500,000 disease aggregate

2. Contractor's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages, and the Contractual liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:

a. General Aggregate (Include per Project Aggregate Endorsement) $ 2,000,000

b. Products - Completed Operations Aggregate $ 2,000,000

c. Personal and Advertising Injury $ 1,000,000

d. Each Occurrence (Bodily Injury and Property Damage) $ 1,500,000.

e. Property Damage liability insurance will provide Explosion, Collapse, and Underground (XCU) coverages. No XCU exclusions.

f. Environmental Impairment or Pollution Liability (Each Occurrence and Aggregate) $ 1,000,000

g. Umbrella Liability

1.	General Aggregate	$ 1,000,000
2.	Each Occurrence	$ 1,000,000

3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

a.	Bodily Injury	$ 1,000,000
b.	Each Person	$ 1,000,000
c	Property Damage	$ 500,000
	OR	
c.	Combined Single Limit of	$ 1,500,000

4. The following shall be included as additional insureds with respect to the insurance required by SC-5.04:

☐ City of Burlington Department of Public Works

☐ Hoyle, Tanner & Associates, Inc. and all subcontractors employed for this project.

SC-5.06.B Amend the first line of paragraph 5.06.B to read as follows:

CONTRACTOR shall purchase and maintain...

SC-5.06.C Delete paragraph 5.06.C in its entirety and insert the following in its place:

C. Should any of the required insurance policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the policy provisions.

SC-5.06.E Delete paragraph 5.06.E in its entirety.

SC-6.06.C Add the following sentence at the end of paragraph 6.06.C:

OWNER or ENGINEER may furnish to any such Subcontractor, Supplier, or other individual or entity, to the extent practicable, information about amounts paid to CONTRACTOR on account of Work performed for CONTRACTOR by a particular Subcontractor, Supplier, or other individual or entity.

SC-6.08 Add the following new paragraphs immediately after paragraph 6.08.A

B. The OWNER has applied for or has obtained the following permits for this project, which are listed below.

1. N/A.

C. Copies of the permits will be provided to the Contractor when given the Notice to Proceed. The CONTRACTOR is responsible for complying with

the project specific conditions outlined in the permits. If the CONTRACTOR intends to proceed with construction means and methods that are outside the General Conditions and Specific Conditions of the permits, it is the CONTRACTOR's responsibility to obtain new permits for these means and methods and to bear all costs associated with applying for and obtaining new permits.

SC-6.17.A Add the following new paragraph immediately after paragraph 6.17.A:

CONTRACTOR shall submit the number of copies which the CONTRACTOR requires, plus two (2) copies (which will be retained by the Engineer) of shop drawings and other submittals to ENGINEER for review.

SC-6.17.E Add the following paragraph immediately after paragraph 6.17.E 1:

2. Engineer shall review a maximum of two (2) submittals of shop drawings or samples for a particular submittal item at no cost to the Contractor. The Contractor shall reimburse the Owner for costs by the Engineer relative to the review of subsequent submittals of shop drawings or samples of the same item.

SC-7.04 Add the following new section immediately after Section 7.03:

SC-7.04 *Claims Between Contractors*

A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, the construction coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, Engineer's Consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree

as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities.

SC-11.03.D Delete paragraph 11.03.D in its entirety and insert the following in its place:

D. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment to determine a mutually acceptable unit price under the following conditions:

1. if the variation in the quantity of a particular item of Unit Price Work performed by CONTRACTOR differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and

2. if there is no corresponding adjustment with respect to any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof; or if OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, either OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

When it is determined either by the OWNER or by the CONTRACTOR that an adjustment is necessary the CONTRACTOR shall propose the adjusted unit price in accordance with Articles 10 and 12, and shall provide supporting documentation of the proposed unit price. No work shall be completed in excess of the quantity amounts as shown in the bid documents without both parties having signed agreement to the adjusted unit price.

SC-13.03 Add the following paragraph immediately after paragraph 13.03.F:

G. CONTRACTOR shall pay all costs associated with any re-inspection and/or retesting of materials and equipment required by the ENGINEER as a result of failure of previous test or rejected work as determined by the ENGINEER. CONTRACTOR shall also pay all costs associated with any <u>additional</u> testing requested by the CONTRACTOR.

SC-14.02 Amend the first line of paragraph 14.02.C.1 to read as follows:

<u>Thirty (30)</u> days after presentation of the...

SC-16.01 Delete Section 16.01 in its entirety and replace with the following:

16.01 Methods and Procedures

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.08 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

END OF SECTION

SECTION 00850
SPECIAL CONDITIONS

The following Special Conditions apply and are hereby made part of the Agreement and Contract Documents.

1.01 PERMITS

A. Permits applied for or obtained by the OWNER, if any, are indicated in paragraph SC-6.08 of the Supplementary Conditions.

1.02 CONSTRUCTION SCHEDULE

A. The OWNER anticipates issuing a Notice to Proceed on this project by August 11, 2015 subject to the successful bidder satisfying the requirements indicated in the Notice of Award.

1.03 CONSTRUCTION OBSERVATION

A. The OWNER will provide a part-time Resident Project Representative at no cost to the CONTRACTOR. The Resident Project Representative is being provided for the benefit of the OWNER, not the CONTRACTOR.

B. The CONTRACTOR shall notify the Engineer a minimum of 24 hours in advance of key construction activities in order to have the Resident Project Representative present and observe the work. The CONTRACTOR shall provide this advance notice for the following construction activities:

1. Selective concrete demolition.

2. Completion of constructing concrete formwork and placing reinforcing steel.

3. All cast-in-place concrete placement operations.

C. Failure of the CONTRACTOR to provide the proper advanced notice of construction activities as indicated in paragraph 1.03-B may be cause for rejection of the work. Any work rejected shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.

END OF SECTION

SECTION 00910
NOTICE OF AWARD
(EJCDC Form C-510)

Dated _____

Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Owner: City of Burlington / Deprtment of Public Works	Owner's Contract No.:
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage		Engineer's Project No.: 909044

Bidder:

Bidder's Address: (send Certified Mail, Return Receipt Requested)

_____

_____

_____

You are notified that your Bid dated ___ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for _____

_____

_____

The Contract Price of your Contract is _____

___ Dollars ($___).

___ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

___ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within fifteen (15) days of the date you receive this Notice of Award.

1. Deliver to the Owner Three (3) fully executed counterparts of the Contract Documents.

2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders (Article 20), and General Conditions (Paragraph 5.01).

3. Other conditions precedent:

   _____

   _____

   _____

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

_____
Owner

By:_____
Authorized Signature

_____
Title

cc: Hoyle, Tanner & Associates, Inc.

END OF SECTION

SECTION 00950
NOTICE TO PROCEED
(EJCDC Form C-550)

Dated _____

Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Owner: City of Burlington / Department of Public Works	Owner's Contract No.:
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage		Engineer's Project No.: 909044

Contractor:

Contractor's Address: [send Certified Mail, Return Receipt Requested]

(PROJECT MANAGER CHOOSE ONE OF THE FOLLOWING OPTIONS)

SINGLE START DATE OPTION

You are notified that the Contract Times under the above contract will commence to run on__. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is____, and the date of readiness for final payment is

OR MULTIPLE START DATE OPTION

You are notified that the Contract Times under the above contract will commence to run on__. On or before that date, you are to start performing your obligations under the Contract Documents. Work at the Site may begin on or after ___, but not before. In accordance with Article 4 of the Agreement, the date of Substantial Completion is___, and the date of readiness for final payment is

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must [add other requirements]:

_____
Owner

Given by:

_____
Authorized Signature

_____
Title

_____
Date

cc: Hoyle, Tanner & Associates

END OF SECTION

NOT FOR CONSTRUCTION
THESE CONTRACT DOCUMENTS ARE FOR REFERENCE AND VIEWING ONLY

SECTION 00960
APPLICATION FOR PAYMENT
(EJCDC Form C-620)

Contractor's Application For Payment No. _____

	Application Period:	Application Date:
To (Owner): City of Burlington / Department of Public Works	From (Contractor):	Via (Resident Engineer)
Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.: 909044

APPLICATION FOR PAYMENT

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. ORIGINAL CONTRACT PRICE	$	
2. Net change by Change Orders	$	
3. CURRENT CONTRACT PRICE (Line 1 ± 2)	$	
4. TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)	$	
5. RETAINAGE:		
a. _____ % x $_____ Work Completed	$	
b. _____ % x $_____ Stored Material	$	
c. Total Retainage (Line 5a + Line 5b)	$	
6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)	$	
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	$	
8. AMOUNT DUE THIS APPLICATION	$	
9. BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)	$	

CONTRACTOR'S CERTIFICATION

The undersigned Contractor certifies that: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

By:	Date:

Payment of: $_____
(Line 8 or other - attach explanation of other amount)

is recommended by: _____ _____
(Resident Engineer) (Date)

Payment of: $_____
(Line 8 or other - attach explanation of other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____
Funding Agency (if applicable) (Date)

Progress Estimate

Contractor's Application

For (contract): Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Application Number:
Application Period:	Application Date:

A				B	C	D	E	F		G
Item		Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)
Bid Item No.	Description									
	Totals									

Stored Material Summary

Contractor's Application

For (contract):	Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage				Application Number:				
Application Period:					Application Date:				
A	B	C	D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
			Date (Month/Year)	Amount ($)	Amount ($)	Subtotal	Date (Month/Year)	Amount ($)	
		Totals							

END OF SECTION

SECTION 00965
FIELD ORDER
(EJCDC Form C-942, Modified)

Field Order No.

Date of Issuance: _____ Effective Date: _____

Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Owner: City of Burlington / Department of Public Works	Owner's Contract No.:
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage		Date of Contract:
Contractor:		Engineer's Project No.: 909044

Attention:
You are hereby directed to promptly execute this Field Order issued in accordance with General Conditions Paragraph 9.04A., for minor changes in the Work without changes in Contract Price or Contract Times. If you consider that a change in Contract Price or Contract Times is required, please notify the Engineer immediately and before proceeding with this Work.

Reference: _____ _____
(Specification Section(s)) (Drawing(s) / Detail(s))

Description:

Attachments:

	Engineer:
Receipt Acknowledged by (Contractor):	Date:

END OF SECTION

SECTION 00970
WORK CHANGE DIRECTIVE
(EJCDC Form C-940)

No._____

Date of Issuance: _____ Effective Date: _____

Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	Owner: City of Burlington / Department of Public Works	Owner's Contract No.:
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage		Date of Contract:
Contractor:		Engineer's Project No.: 909044

You are directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

_____

_____

Purpose for Work Change Directive:

☐ Authorization for Work described herein to proceed on the basis of Cost of the Work due to:

☐ Nonagreement on pricing of proposed change.

☐ Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.

Estimated change in Contract Price and Contract Times:

Contract Price $ _____ (increase/decrease) Contract Time _____ (increase/decrease)
days

If the change involves an increase, the estimated amounts are not to be exceeded without further authorization.

Recommended for Approval by Engineer:	Date
Authorized for Owner by:	Date
Accepted for Contractor by:	Date
Approved by Funding Agency (if applicable):	Date:

END OF SECTION

SECTION 00980
CHANGE ORDER
(EJCDC Form C-941)

No._____

Date of _____ Effective _____

Project:	Owner:	Owner's Contract No.:
Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage	City of Burlington / Department of Public Works	
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage / Marketplace Garage		Date of Contract:
Contractor:		Engineer's Project No.: 909044

The Contract Documents are modified as follows upon execution of this Change Order:

Description:

Attachments (list documents supporting change):

CHANGE IN CONTRACT PRICE:	**CHANGE IN CONTRACT TIMES:**
Original Contract Price:	Original Contract Times: ☐ Working days ☐ Calendar days Substantial completion (days or date): _____ Ready for final payment (days or date): _____
$_____	
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___:	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial completion (days): _____ Ready for final payment (days): _____
$_____	
Contract Price prior to this Change Order:	Contract Times prior to this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
$_____	
[Increase] [Decrease] of this Change Order:	[Increase] [Decrease] of this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
$_____	
Contract Price incorporating this Change Order:	Contract Times with all approved Change Orders: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
$_____	

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Date: _____	Date: _____	Date: _____
Approved by Funding Agency (if applicable): _____		Date: _____

END OF SECTION

SECTION 00990
CERTIFICATE OF SUBSTANTIAL COMPLETION
(EJCDC Form C-625)

Project: Municipal Parking Garage Repairs Project - Phase I College Street Garage Marketplace Garage	Owner: City of Burlington / Department of Public Works	Owner's Contract No.:
Contract: Municipal Parking Garage Repairs Project - Phase I College Street Garage Marketplace Garage		Date of Contract:
Contractor:		Engineer's Project No.: 909044

This [tentative] [definitive] Certificate of Substantial Completion applies to:

☐ All Work under the Contract Documents: ☐ The following specified portions:

_____

_____

_____

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [revised tentative] [definitive] list of items to be completed or corrected, is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

☐ Amended Responsibilities ☐ Not Amended

Owner's Amended Responsibilities:

_____

_____

_____

Contractor's Amended Responsibilities:

_____

_____

_____

The following documents are attached to and made part of this Certificate:

_____

_____

_____

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

_____ _____
Executed by Engineer Date

_____ _____
Accepted by Contractor Date

_____ _____
Accepted by Owner Date

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract Description.

B. Work by Owner.

C. Owner supplied Products.

D. Contractor use of site.

E. Future work.

F. Work Sequence.

G. Owner occupancy.

1.2 RELATED SECTIONS

Not Used.

1.3 CONTRACT DESCRIPTION

A. Contract Type: Stipulated Price as described in Agreement.

1.4 WORK BY OWNER

Not Used.

1.5 OWNER SUPPLIED PRODUCTS

Not Used.

1.6 CONTRACTOR USE OF SITE

A. Limit use of site to allow:

1. Owner access.
2. Allow access to local property owners.

B. Construction Operations: Limited to right-of-way and easement areas as shown on the drawings.

C. Time Restrictions for Performing Work: The CONTRACTOR will be limited to accessing the site and performing the required work between the hours of 7:00am to 7:00pm, Monday through Friday unless granted written consent by the OWNER. Select operations are scheduled to be completed outside of these hours as indicated

on the plans.

1.7 FUTURE WORK

Not Used.

1.8 WORK SEQUENCE

A. Construct Work as shown on the drawings, coordinate construction schedule and operations with Engineer.

1.9 OWNER OCCUPANCY

Not Used.

1.10 CONSTRUCTION PERMITS AND EASEMENTS

A. The owner shall be responsible for identifying and obtaining federal, state, and local permits as may be required due to the nature and location of construction except those required to be obtained by the Contractor such as trench permits, building permits, waste disposal permits, etc. To the extent possible, Owner procured permits shall be obtained prior to the Advertisement for Bids for construction, and copies of all permits so obtained shall be included in the Appendix. The status of the application on each permit, including the conditions thereof, not obtained prior to the Advertisement for Bids shall also be indicated in the Supplementary Conditions.

B. When construction permits are accompanied by regulations or requirements issued by a particular authority or agency, it shall be the Contractor's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this project.

C. The Owner shall be responsible for identifying and obtaining all easements for this contract prior to construction.

D. The Owner has applied for or obtained the following permits:

1. N/A.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowance.

C. Inspecting and testing allowances.

D. Schedule of Values.

E. Application for payment.

F. Change procedures.

G. Measurement and payment - unit prices

H. Alternatives.

1.2 RELATED SECTIONS

Not Used.

1.3 CASH ALLOWANCES

Not Used.

1.4 CONTINGENCY ALLOWANCE

Not Used.

1.5 INSPECTING AND TESTING ALLOWANCES

Not Used.

1.6 SCHEDULE OF VALUES

A. Submit a printed schedule of values in accordance with Section 00700, paragraph 2.05-A. for all lump sum bid items of the work. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement established in Notice to Proceed.

C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section.

D. Include in each line item, the amount of Allowances specified in this section.

E. Include within each line item, a direct proportional amount of Contractor's overhead and profit.

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

1.7 APPLICATIONS FOR PAYMENT

A. Submit three (3) copies of each application on Contractor's electronic media driven form or EJCDC C-620 (Section 00960).

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: 30 days.

D. Include any forms required by Owner.

E. Include an updated construction progress schedule.

1.8 CHANGE PROCEDURES

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by the General Conditions.

B. The Engineer may issue a Change Order which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within seven (7) days.

C. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01600.

D. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under a Work Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

E. Work Change Directive: Engineer may issue a directive, on EJCDC Form C-940 Work Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change

in Contract Sum/Price or Contract Time. Promptly execute the change.

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

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

H. Change Order Forms: EJCDC C-941 Change Order (Section 00990).
Work Change Directive Forms: EJCDC C-940 (Section 00970).

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

1.9 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.

1.10 MEASUREMENT AND PAYMENT - UNIT PRICES

A. Authority: Measurement methods are delineated in the individual specification sections.

B. Take measurements and compute quantities. The Engineer will verify measurements and quantities proposed by the Contractor, or the Engineer will take measurements and compute quantities accordingly. Provide and assist in the taking of measurements.

C. Unit Quantities: Quantities and measurements indicated in the Bid Form are for bidding purposes only. Actual quantities provided shall determine payment.

D. Payment Includes: Full compensation for required labor (including sales tax), products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.11 ALTERNATIVES

Not Used.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Preinstallation meetings.

G. Equipment electrical characteristics and components.

H. Examination.

I. Preparation.

J. Cutting and Patching.

K. Alteration project procedures.

1.2 RELATED SECTIONS

Not Used.

1.3 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of the various sections of the Specifications to ensure efficient and orderly sequence of construction elements.

B. Verify all existing utility locations.

1.4 FIELD ENGINEERING

A. The Contractor shall confirm drawing dimensions and elevations.

B. The Contractor shall provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

C. The Contractor shall furnish assistance to the Engineer as requested to check the layout or otherwise control the work. Such assistance shall be understood to include the provision of suitable manpower to assist the Engineer in taping measurements,

holding a survey rod for checking grades and the like.

D. The Engineer reserves the right to inspect or check any of this work, and the Contractor shall not claim added compensation for any delay occasioned by the Engineer exercising this right, nor for any corrective work which is required as a result of the Engineer's inspections.

1.5 PRECONSTRUCTION MEETING

A. Engineer will schedule a meeting after Notice of Award.

B. Attendance Required: Owner, Engineer and Contractor.

C. Agenda:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, schedule of values, and progress schedule.
5. Submission of list of surveyor or person responsible for layout, testing agency and other parties providing services on the project.
6. Designation of personnel representing the parties in Contract, and the Engineer.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Procedures for layout of the project, establishing controls, limits of right-of-way and easements.
9. Scheduling.

D. Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.6 SITE MEETING

A. Engineer may schedule a meeting at the Project site prior to Construction start-up.

B. Attendance Required: Engineer, Contractor's Superintendent, and major Subcontractors.

C. Agenda:

1. Use of site by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities provided by Contractor.
4. Temporary utilities provided by Contractor.
5. Survey layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.

9. Procedures for testing.
10. Procedures for maintaining record documents.

D. Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.7 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at weekly intervals or intervals agreed to by Owner/Engineer/Contractor.

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

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

D. Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

E. Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.8 PREINSTALLATION MEETING

Not Used.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

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

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

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:

1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

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

F. Restore Work with new Products in accordance with requirements of Contract Documents.

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

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

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

J. Identify hazardous substances or conditions exposed during the Work to the Engineer for decision or remedy.

3.2 ALTERATION PROJECT PROCEDURES

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

B. Employ skilled and experienced installer to perform alteration work.

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

D. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original or specified condition.

E. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified or renewed condition for each material, with a neat transition to adjacent finishes.

F. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

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

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

I. Finish surfaces as specified in individual Product sections.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed Products list.

D. Product Data.

E. Shop Drawings.

F. Samples.

G. Design data.

H. Test reports.

I. Certificates.

J. Manufacturer's instructions.

K. Manufacturer's field reports.

L. Erection drawings.

M. Construction photographs.

1.2 RELATED SECTIONS

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

B. Section 01700 - Contract Closeout: Contract warranties, bonds, manufacturers' certificates, and closeout submittals.

1.3 REFERENCES

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

1.4 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

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

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

E. Schedule submittals to expedite the Project, and deliver to Engineer at Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner), Inc. 125 College Street, 4th Floor, Burlington, VT 05401. Coordinate submission of related items. Or, discuss delivery format in Pre-Construction Meeting – use electronic submission process (e-mail or project collaboration site) when allowed.

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

G. Identify variations from Contract Documents which may be detrimental to successful performance of the completed Work.

H. Provide space for Contractor and Engineer review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

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

L. The cost of furnishing drawings and details, calculations, product data, samples, test reports and certificates shall be included in the Contract unit price for the item involved.

1.5 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule in duplicate within ten (10) days after date of Owner-Contractor Agreement established in Notice to Proceed.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first workday 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 and required by Allowances.

1.6 PROPOSED PRODUCTS LIST

A. Within fifteen (15) days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.7 PRODUCT DATA

A. Product Data For Review:

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

B. Submit the number of copies as indicated in the General Conditions.

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

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

1.8 SHOP DRAWINGS

A. Shop Drawings For Review and Approval:

1. Submitted to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
2. The Contractor or fabricator shall not begin work on the activity or fabrication involved without approval of the details and procedures. Engineer’s approval

of drawings and procedures does not relieve the Contractor or fabricator of compliance with all specifications and code requirements. The Engineer assumes no responsibility for error(s) and/or omission(s) of details.

3. Drawings and procedures identified as “approved as noted” indicate that specific clarification or conditional changes have been identified and take precedence over submitted information. Withholding of approval by the Engineer for selected details, calculations or procedures shall not constitute a basis for delay.
4. After approval of the drawings, details and procedures, no changes shall be made without written approval of the Engineer. The Contractor or fabricator shall assume risk for materials ordered or work performed prior to the approval of the Engineer.
5. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700 - CONTRACT CLOSEOUT.

B. Shop drawings to be submitted fall into two (2) categories:

1. Fabrication Drawings: Drawings required for work performed by or in conjunction with materials furnished by a fabricator or supplier. Drawings provided to the Engineer for review and approval shall consist of complete details developed from information in the Plans and these Specifications to define dimensions, sizes, procedures, and materials necessary to complete fabrication and installation or erection of the work specified.
2. Working Drawings: Drawings submitted for review and approval shall include, but not be limited to; the following: temporary bridge plans, removal of existing bridge structure plans, cofferdam plans, water diversion structure plans, plans of precast elements to be designed by the Contractor, erection plans, temporary support systems, falsework plans, scaffolding plans and bridge analysis, detour plans, sign structure plans, traffic signal poles and mast arm plans, or any other working drawings for review and approval required by the Contract. If not specifically noted in the applicable Technical Specifications, all items listed above must be designed and sealed by a Professional Engineer licensed in the State of New Hampshire.

Shop drawings that must be submitted for review and approval are listed in Section 01300, Paragraph 3.1.C.

C. Submit the number of opaque reproductions as indicated in the General Conditions.

1.9 SAMPLES

A. Samples For Review:

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

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

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

D. Submit the number of samples as indicated in the General Conditions.

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

F. Samples will not be used for testing purposes unless specifically stated in the specification section.

1.10 DESIGN DATA

A. Submit for the Engineer's review and approval as contract administrator.

B. Submit information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.

C. For an item or element of work which includes optional design data and calculations that affect structural capacity, safety, and/or the results of work, the Contractor shall prepare for the Engineer’s review and approval detailed design data and calculations of how the work is proposed to be performed and adequately controlled.

1.11 TEST REPORTS

A. Submit test reports for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.12 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor using the Certificate of Compliance form at the end of this section or an approved equal, to Engineer, in quantities specified for Product Data.

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

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

1.13 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Engineer for delivery to the site in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. Refer to Section 01400 - Quality Control, Manufacturers' Field Services article.

1.14 MANUFACTURER'S FIELD REPORTS

Not Used.

1.15 ERECTION DRAWINGS

Not Used.

1.16 CONSTRUCTION PHOTOGRAPHS

Not Used.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 SUBMITTALS

A. The Contractor shall provide to the Engineer product data, shop drawings, samples, Certificates of Compliance and other submittals to the Engineer as indicated in the submittal summary provided in this section. The summary provided is not all inclusive and does not relieve the contractor from providing all submittals identified or call for in the Contract Documents (plans and individual section specifications).

B. Product Data

Submit the following product data:

Spec #	**Section**	**Item**
01300	1.6 A,B	Products List
01700	1.9-B	Warranties
024119	1.06D	Double-Tee Top Flange Coatings
030130	1.05B	Product Data Sheets and MSDS
030130	1.05C	Galvanized Anode Manufacture Extended Limited Warranty
033000	1.04B	Concrete Mix Design

Spec #	Section	Item
034200	1.05B	Elastomeric Bearing Pad
042000	1.03B	Masonry, Mortar Product Data
058000	1.04B-(2)	Stainless Steel Bolts
058000	1.04C	Stair Treads
058000	1.04D	Stainless Steel Drain Pipe Guards
058010	1.04B	Detectable Warning Devices
071800	1.04B	Product Literature and Instructions
071900	1.04B	Product Literature and Instructions
075300	1.03B	Product Literature
079200	1.04B	Product Literature and Instructions
081113	1.03B	Materials and Details
084313	1.03B	Component Dimensions and Details
084313	1.03E	Warranty
084413	1.05B	Component Dimensions and Descriptions
084413	1.05E	Product Certification
084413	1.05I	Warranty
088000	1.05B	Glazing Compounds
088000	1.05C	Warranty
099600	1.03B	Product Literature and Instructions
099600	1.03C	Warranty
099723	1.03B	Coating Materials Data
099723	1.03C	Warranty
101400	1.03B	Product Literature and Instructions
142400	1.05B	Car Details and Design
142400	1.05D	Warranty
142400	1.05G	Operation and Maintenance Data
221006	1.04B	Component Sizes and Finishes
221009	1.04A	Pipe, Tube, Fittings and Couplings
223000	1.05B	Water Heaters, Pumps, and Electrical Characteristics
223000	1.05D	Operation and Maintenance Data
223000	1.05E	Warranty
230548	1.04B	Product Literature and Instructions
230713	1.04B	Product Descriptions, Characteristics and Locations
230719	1.04B	Product Descriptions, Characteristics and Locations
232300	1.05B	Manufacturers Catalog Data
233100	1.04B	Duct Materials
233100	1.04C	Firestoping Materials

C. Shop Drawings

Submit working drawings for review and approval for the following:

Spec #	Section	Item
01100.12		Traffic Control Plan
024119	1.06B	Proposed Protection Measures
024119	1.06C	Schedule of Selective Demolition Activities
058000	1.04B-(1)	Bollard Rehabilitation Plan
075300	1.03C	Joint or Termination Detail Conditions
076200	1.05B	Material Profile and Details
081113	1.03C	Details of Opening
081113	1.03D	Hardware Schedule
084313	1.03C	System Dimensions and Details
084313	1.03D	Hardware Schedule
084413	1.05C	System Dimensions and Details
084413	1.05D	Sealant Glazing and Weathering Sealant Details
101400	1.03C	Signage Schedule
142400	1.05C	Elevator Machine Equipment
221006	1.04C	Dimensions, Weights and Placements
221006	1.04F	Project Record Documents
223000	1.05C	Tank Dimensions, Lining and appurtenances
230548	1.04F	Seismic Bracing for Plumbing Piping
233100	1.04D	Duct Fittings, Gages, Sizes, and etc.
238129	1.05G	Installation Drawings
260500	1.05B	Nonstandard or Custom Fixtures
260533	1.05B	Nonstandard or Custom Fixtures
262726	1.04B	Legends for receptacles and switch plates
265210	1.04B	Nonstandard or Custom Fixtures
265210	1.04C	Ceiling Plans
265210	1.04D	Nonstandard or Custom Fixtures
265210	1.04F	Anchor-bolt Templates
321313	1.03B	Landscape Plans
321313	1.04G	Score and Joint layouts
323119	1.04B	Fence Plan Layout

D. Samples

Spec #	Section	Item
042000	1.03C	Samples
101400	1.03D	Samples
262726	1.04C	Samples
321313	1.04H	Samples
321313	1.04I	Samples

E. Design Data

Spec #	Section	Item
084413	1.05F	Framing Calculations
232300	1.05D	Pipe Sizing and Load Capacities
238129	1.05C	Design Calculations and ASHRAE Requirements

F. Test Reports

Spec #	Section	Item
024119	1.08A	Water Soluble Chloride Ion Tests
033000	1.04D	Material Test Reports
084413	1.05G	Full-Size Mock-Up Testing
084413	1.05H	Water Leakage
321313	1.04E	Material Test Reports

G. Certificates

Spec #	Section	Item
033000	1.04C	Material Certificates
220500	1.05B	Welders' Certificates
321123	1.04A	Aggregate Base Certificate of Compliance
321313	1.04D	Batch Slips

H. Manufacturers Instructions

Spec #	Section	Item
01300	1.13 A&B	Manufacturer's Instructions
221006	1.04D	Installation Instructions, Assembly and Support Requirements
221006	1.04E	Installation Instructions, Spare Parts Lists

Spec #	Section	Item
230548	1.04G	Installation Instructions
230719	1.04C	Installation Procedures
232300	1.05F	Support, Isolation Requirements and Isolations
233300	1.04D	Fire Dampers
233423	1.04C	Installation Instructions

I. Submissions Requiring Professional Engineer or Other Certifications

Spec #	Section	Item
		Beam Jacking Plan and Calculations
024119	1.06E	Spandrel Beam Removal and Reattachment Plan

J. Other Submittals

Spec #	Section	Item
00700	2.05A	Progress Schedule
00700	2.05A	Schedule of Value
00700	2.05A	List of Submittals
01039	1.5-(4)	List of Subcontractors
01300	1.5 A-G	Progress Schedule
01700	1.3 A-C	Closeout Procedures
01700	1.6 A-G	Record Documents
024120	1.05A	Hydrodemolition
099600	1.03D	Cleaning, Repair and Patching Techniques
099723	1.03D	Cleaning, Repair and Patching Techniques
142400	1.05E	Maintenance Contract
232300	1.05H	Record Drawings
232300	1.05I	Maintenance Data
233100	1.04F	Record Drawings

3.2 ENGINEER'S REVIEW

A. The Engineer will review initial and second submittals made by the Contractor for each item at no cost to the Contractor. Engineer's fees and charges for review of resubmittal (beyond the second resubmittal) shall be paid for by the Contractor.

1. Payment for review of resubmittals will be charged to the contractor by deducting charges from the total contract sum/price.

CERTIFICATE OF COMPLIANCE

Date _____ 20_____

WE, _____

(Manufacturer, Supplier, or Contractor)

Address: _____

HEREBY CERTIFY THAT _____

(Type of Product)

_____

(Product Trade Name)

Manufactured by _____

Supplied by: _____

Furnished to _____

Contractor (Prime or Sub.)

Delivered and Used on:

_____ _____ _____

Project Name Federal No. State No.

Used for Item No. _____ _____

Name of Item

MEETS THE REQUIREMENTS OF THE PERTINENT PROJECT PLANS, SPECIAL PROVISIONS AND SPECIFICATIONS OF THE PROJECT CONTRACT DOCUMENTS IN ALL RESPECTS. PROCESSING, PRODUCT TESTING, AND INSPECTION CONTROL OF RAW MATERIALS ARE IN CONFORMANCE WITH ALL APPLICABLE SPECIFICATIONS, DRAWINGS AND STANDARDS OF ALL ARTICLES FURNISHED.

All records and documents pertinent to this certificate and not submitted herewith will be maintained available by the undersigned for a period of not less than three years from the date the Project has been completed and accepted.

Signed by _____ Title _____

(Officer of Organization)

Subscribed and sworn to before me this _____ day of _____,_____.

_____ My Commission Expires:_____

Notary Public/Justice of the Peace

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - control of installation.

B. Tolerances

C. References and standards.

D. Mock-up.

E. Inspecting and testing laboratory services.

F. Manufacturers' field services.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.

B. Section 01600 - Material and Equipment: Requirements for material and product quality.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

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

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

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

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

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

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

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

1.4 TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.5 REFERENCES AND STANDARDS

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

B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

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

1.6 MOCK-UP

Not Used.

1.7 MATERIAL TESTING AND LABORATORY SERVICES

A. Owner or Engineer may appoint, employ, and pay for specified services of an independent firm to perform construction testing services.

B. The independent firm will perform testing and other services specified in individual sections and as required by the Owner or Engineer.

C. Testing reports will be submitted by the independent firm to the Owner or engineer indicating services and indicating compliance or non-compliance with the contract documents.

D. Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.

1. Notify Engineer and/or independent firm 48 hours prior to expected time for operations requiring services. These operations include, but are not necessarily limited to:

- Cast-in-place concrete placement

E. All additional testing or re-testing necessitated by the failure of initial tests as determined by the Engineer shall be conducted and paid for by the Contractor as directed by the Engineer.

1. The Contractor shall take immediate corrective measures as suggested by the testing laboratory and/or directed by the Engineer to make the materials meet or exceed the specifications.

2. Payment for additional testing or re-testing will be charged to the Contractor by deducting charges from the total contract sum/price.

1.8 OBSERVATION SERVICES

A. Owner may appoint, employ, and pay for specified services of an independent firm to perform observation.

B. The independent firm will perform observations and other services specified in individual specification sections and as required by the Owner.

C. Reports will be submitted by the independent firm to the Owner, in duplicate, indicating observations and indicating compliance or non-compliance with Contract Documents.

D. Contractor shall cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.

1. Notify Engineer and/or independent firm 48 hours prior to expected time for operations requiring services.

E. Observations do not relieve Contractor to perform Work to contract requirements.

1.9 MANUFACTURERS' FIELD SERVICES

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

B. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer subject to approval of Engineer.

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

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

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.2 PREPARATION

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

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

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

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: telephone/fax service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, water control and erosion controls.

C. Construction Facilities: Access roads, parking, progress cleaning and project signage.

1.2 RELATED SECTIONS

A. Section 01700 - Contract Closeout: Final cleaning.

1.3 TEMPORARY ELECTRICITY

A. Contractor shall have access to parking garage electrical services for construction operations. Contractor shall be responsible for coordinating equipment demand and circuit capacity.

B. If extensive electrical usage, as determined by the Engineer, is needed for the project or an operation, the OWNER may request separate metering be installed at the expense of the Contractor and the Contractor shall pay for the cost of electricity used.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

Not Used.

1.5 TEMPORARY HEATING

A. Should certain construction operations require heating, it shall be provided and maintained at the Contractor's expense.

1.6 TEMPORARY COOLING

Not Used.

1.7 TEMPORARY VENTILATION

Not Used.

1.8 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization. At the Contractor's option, telephone service to a field office can be

substituted with a cell phone with voice mail assigned to the Contractor's foreman provided the cell phone reception is adequate at the project site.

1.9 FACSIMILE SERVICE

Not Used.

1.10 TEMPORARY WATER SERVICE

B. Provide, maintain and pay for suitable quality water service required for construction operations at time of project mobilization.

C. Contractor will pay cost of water used. Exercise measures to conserve water. Provide separate metering if obtaining from local water utility and reimburse Owner for cost of water used.

D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.11 TEMPORARY SANITARY FACILITIES

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

F. At end of construction, return facilities to same or better condition as originally found.

1.12 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building, if applicable.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

E. Provide barrier protection for dust control during demolition operations.

1.13 FENCING

Not Used.

1.14 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide erosion control barriers as required to protect site from soil erosion.

1.15 EXTERIOR ENCLOSURES

Not Used.

1.16 INTERIOR ENCLOSURES

Not Used.

1.17 PROTECTION OF INSTALLED WORK

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

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

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

D. Prohibit traffic from landscaped areas.

1.18 SECURITY

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

B. Coordinate with Owner's security program.

1.19 ACCESS ROADS

Not Used.

1.20 PARKING

A. Construction personnel shall park within the project limits so as not to obstruct local traffic and construction activities.

1.21 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Collect and remove waste materials, debris, and rubbish from site daily and dispose off-site.

1.22 PROJECT IDENTIFICATION

Not Used.

1.23 FIELD OFFICES AND SHEDS (Optional for this Project)

A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate four (4) persons.

C. Provide separate work area or workstation, similarly equipped and furnished, for use of Engineer.

D. Locate offices and sheds a minimum distance of 30 feet from existing structures. If a field office is not provided by the Contractor for the project, an enclosed, weather tight area such as a tool storage trailer with sufficient space to layout the plans and provide for storage of the project plans, specifications and project submittals shall be provided.

1.24 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities and materials, prior to Final Application for Payment.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing and permanent land and facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.25 DUST CONTROL

Not Used.

1.26 ADVERSE CONDITIONS

A. NIGHT WORK

1. Work after dark will not be permitted except under extreme emergency, or only under special directions, and only if permitted by the Engineer.

2. Whenever the Contractor finds it necessary or expedient to do work at night, such night work shall be performed by the Contractor without additional or extra cost to the Owner, and only with the Owner's approval. The Contractor shall provide all lights required for the proper and expeditious carrying on of any work.

3. The placing of concrete shall be started early enough in the daylight hours to insure completion of the section under construction before dark.

B. WEATHER CONDITIONS

1. No work shall be done when the weather is unsuitable. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials or equipment from damage or deterioration due to floods, driving rain, or wind and snowstorms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protective measures over and beyond those proposed by the Contractor, be taken to safeguard all components of the project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the work from weather elements.

2. The mixing and placing of concrete or pavement courses, the laying of masonry, and installation of sewers and water mains shall be stopped during rain storms; all freshly placed work shall be protected by canvas or other suitable covering in such manner as to prevent running water from coming in contact with it. Sufficient coverings shall be provided and kept ready at hand for this purpose. The limitations and requirements for mixing and placing concrete, or laying of masonry, in cold weather shall be as described elsewhere in these specifications.

1.27 POLICING

A. GENERAL

1. When, in the opinion of the Owner, or the Engineer, public safety or convenience requires the services of police, the Engineer may direct the Contractor to request the local police department to assign uniformed offices to direct traffic within the location of work under the Contract.

2. When so directed, the Contractor shall make all arrangements in obtaining police assistance and shall pay all police officers. The police shall, at all times, be subject to the direction and control of the Contractor.

3. The intent is to ensure public safety by police direction of traffic. Police are not to serve as watchmen to protect the Contractor's equipment and materials, or to warn pedestrians of such hazards as open trenches.

4. Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property under the terms of the Contract, or for providing necessary traffic control including signs, barricades, or flagmen as required in Section 01500 of these specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.2 RELATED SECTIONS

A. Document 00100 - Instructions to Bidders: Substitute and "or equal" items procedures.

B. Section 01400 - Quality Control: Quality Assurance - Control of Installation.

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacture for components being replaced.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

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

B. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.7 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only within thirty (30) days after date of Owner-Contractor Agreement.

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

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

D. A request constitutes a representation that the Contractor:

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

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

F. Substitution Submittal Procedure:

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

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

F. Spare parts and maintenance Products.

G. Warranties and bonds.

H. Maintenance service.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls: Progress cleaning.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Provide submittals to Engineer that are required by governing or other authorities.

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

1.4 FINAL CLEANING

A. Execute final clean up and restoration of all disturbed areas prior to final project assessment.

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

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

1.5 ADJUSTING

Not Used.

1.6 PROJECT RECORD DOCUMENTS

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

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

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

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of footing in relation to finish ground or brook elevation.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

G. Submit documents to Engineer with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

Not Used.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

Not Used.

1.9 WARRANTIES AND BONDS

A. Provide duplicate notarized copies.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing date of acceptance as start of warranty period.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of all work items indicated in the Contract Documents for one year from date of Substantial Completion.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

All work shall be completed in accordance with the attached Technical Specifications. This project does not utilize and Supplemental Specifications and Special Provisions

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SECTION 011000

MOBILIZATION/DEMOBILIZATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of preparatory work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to and from the project site; for the establishment and removal of all Contractor's field offices, buildings, and other facilities necessary for work on the project; and for all other work and operations that must be performed or costs incurred prior to beginning work and upon completion of Contract items. It shall also include compensation for any costs associated with demobilization, project clean up, establishment of vegetation, and completion of all work that is not associated with acceptance of a specific pay item.

1.02 RELATED SECTIONS

A. General Requirements.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Mobilization/Demobilization will be measured for payment at the Contract unit price on a lump sum basis.

4.02 PAYMENT

A. The accepted quantity of Mobilization/Demobilization of the College Street Garage Phase I repairs will be paid for at the Contract lump sum price. Payment will be full compensation for performing the work specified and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per lump sum. Partial payments will be made as follows: 50% partial payment with the first payment request for this garage, 40% partial payment following the completion of 20% of the contract, excluding mobilization/demobilization, 10% will be made after the final acceptance date with the final payment request.

Pay Item	Pay Unit
011000.01	Lump Sum

B. The accepted quantity of Mobilization/Demobilization of the Marketplace Garage Phase I repairs will be paid for at the Contract lump sum price. Payment will be full compensation for performing the work specified and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per lump sum. Partial payments will be made as follows: 50% partial payment with the first payment request for this garage, 40% partial payment following the completion of 20% of the contract, excluding mobilization/demobilization, 10% will be made after the final acceptance date with the final payment request.

Pay Item	Pay Unit
011000.02	Lump Sum

END OF SECTION 011000

SECTION 012000

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of establishing and maintaining traffic control measures to protect the traveling public (including bicyclists and pedestrians) and construction operations.

1.02 RELATED SECTIONS

A. Contract Drawings.
B. General Requirements.

1.03 REFERENCES

A. Manual on Uniform Traffic Control Devices (MUTCD)

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals

Working Drawings: Provide detailed sign package information such as location, type, size and color. Provide typical work zone layout to show delineation between work zones and travel ways. Plans shall indicate the location of spaces that will be taken out of service during each phase of construction.

1.05 QUALITY ASSURANCE

A. Not Used.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Traffic control devices shall be kept clean so they are clearly visible at all times.

1.07 COORDINATION

A. Contractor shall coordinate all traffic control including but not limited to changes of traffic pattern, reduction of available parking stalls, detours, etc. with the Design Engineer prior to commencement of work.

PART 2 PRODUCTS

2.01 TRAFFIC CONTROL DEVICES

A. All traffic control devices shall conform to the requirements of the Contract and the latest edition of the MUTCD.
B. All signs shall be composed of the same retroreflective material. The Contractor shall conduct inspections of both daytime and nighttime operations daily in order to ensure proper placement and operation of all traffic control devices.

PART 3 EXECUTION

3.01 FIELD ADJUSTMENTS

A. The traffic control layout shall be adjusted in the field as directed by the Engineer to provide for maximum visibility and usefulness.

B. Contractor may propose field changes to the traffic control layout with approval of the Engineer.

3.02 PARKING SPACE CLOSURE LIMITS

A. The Contractor shall conduct the work to minimize the number of parking spaces taken out of service that includes areas for material storage, temporary traffic patterns, and contractor vehicles and equipment. 60 spaces per level and 120 total spaces may be closed at one time.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Traffic Control to be measured for payment will be on a lump sum basis for providing traffic control in the complete and accepted work.

4.02 PAYMENT

A. The accepted quantity of Traffic Control at the College Street Garage will be paid for at the Contract lump sum price. Payment will be full compensation for preparing, implementing, inspecting, maintaining, and removing the applicable traffic control plan and specified traffic control devices, and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work. Partial payments will be made as follows: The first 25% of the Contract lump sum price will be paid upon the complete installation of the traffic control devices prior to the start of work. The remaining 75% of the Contract lump sum price will be paid on a prorated basis for the estimated duration of the Contract work remaining.

Pay Item	Pay Unit
012000.01	Lump Sum

B. The accepted quantity of Traffic Control at the Marketplace Garage will be paid for at the Contract lump sum price. Payment will be full compensation for preparing, implementing, inspecting, maintaining, and removing the applicable traffic control plan and specified traffic control devices, and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work. Partial payments will be made as follows: The first 25% of the Contract lump sum price will be paid upon the complete installation of the traffic control devices prior to the start of work. The remaining 75% of the Contract lump sum price will be paid on a prorated basis for the estimated duration of the Contract work remaining.

Pay Item	Pay Unit
012000.02	Lump Sum

END OF SECTION 012000

SECTION 024119

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Demolition of selective portions of the existing structure for the completion of Work under this Contract as indicated on the Contract Drawings. Types of Selective Demolition Work includes the following:
   1. Removal of existing Cast-In-Place concrete wash areas and other identified concrete removal as indicated on the Drawings to complete the repair Work.
   2. Removal of portion of College Street Level 4 double-tee beam flanges for drain installation as indicated on the Drawings.
   3. Testing of Concrete of four (4) representative concrete samples for drain installation.
   4. Removal of accumulated debris and preparation of surfaces by pressure washing areas of garage to receive coatings/sealers.
   5. Removal and reinstallation of Marketplace spandrel beam.
   6. Installation of protective beam fabric to contain spalled beam concrete until phase 2 repairs can be completed.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. General Requirements.

1. Section 012000 Traffic Control
2. Section 071900 Water Repellants

1.03 DEFINITIONS

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

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

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

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

1.04 REFERENCES

A. ASTM International (ASTM)
   1. C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete

1.05 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.
B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.
B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers. See section 3.02 for additional requirements
C. Schedule indicating proposed sequence of operations for selective demolition Work.
D. Product Data: Submit Manufacturer's product literature and installation instructions for double-tee top flange coatings after demolition.
E. Spandrel beam removal and reattachment plan. Contractor shall prepare and submit with design calculations stamped by a Vermont licensed structural engineer a detailed plan for the detachment, lifting, storage, and reattachment of the existing spandrel beam identified on the Marketplace contract drawings.

1.07 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practicable.
B. Storage or sale of removed items on-site is not permitted.
C. Notify Design Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
D. Damages: Promptly repair damages caused to adjacent facilities by demolition Work at no cost to Owner.
E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer. Hazardous materials will be removed by Owner under a separate contract.
F Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

   1. Hazardous material remediation is specified elsewhere in the Contract Documents.
   2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
   3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be

selectively demolished because of building operations or processes performed there.

G. Traffic: Phase selective demolition operations and debris removal in a manner to maintain existing traffic patterns. See Technical Specification section 012000 for additional traffic requirements.

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

1.08 TESTING

A. Contractor shall employ a qualified concrete testing lab to perform Chloride Ion testing of the concrete flange sections removed.
   1. Concrete sections for new drain installations shall be secured as test samples from four (4) locations identified by the Design Engineer. Contractor shall have samples tested in accordance with the following testing procedures with results reported back to Engineer:
      a. Water Soluble Chloride Ion Tests (ASTM C1218)

1.09 WARRANTY

A. Not used.

PART 2 PRODUCTS

2.01 EXPOSED STEEL COATINGS

A. Products to be used on the exposed reinforcing. 2 coats at 6.0 to 8.0 mils per coat.
   2. RD Elastometal
   3. Tnemic Series 118
   4. Or Approved Equal.

2.02 BEAM PROTECTIVE FABRIC WRAP

A. Products to be used for beam protective fabric wrap shall be as follows:

   1. Pucuda LenoWeave #18K unfoamed
   2. Or Approved Equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to commencement of selective demolition Work, inspect areas in which Work will be performed. At Contractor's option, photograph existing conditions of structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition Work; file with the Design Engineer prior to starting Work.

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

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

3.02 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with and protection of pedestrian and vehicular traffic both on the level being worked on and the levels above or below that may be impacted.

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

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

D. Protection: Provide temporary barricades and other forms of protection as required to protect the general public from injury due to selective demolition Work.

1. Protect from damage to existing to remain finished Work that is to remain in place and becomes exposed during demolition operations.
2. Construct temporary dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.
3. Remove protection at completion of Work.
4. Post warning signs which are clearly visible.
5. Provide traffic barrier at spandrel beam removal.
6. Provide fall protection for spandrel beam removal.

3.03 SELECTIVE DEMOLITION, GENERAL

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, to minimize disturbance of adjacent surfaces. Use of chipping hammers heavier than nominal 15 pound class are not permitted. 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 structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly

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

3.04 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Cast-In-Place Concrete Wash Areas: Saw-cut perimeter of area to be demolished per the limits and depth as indicated on the Contract Drawings, then break up and remove.

B. Revise "Resilient Floor Coverings" Paragraph below if more aggressive removal techniques such as shot blasting are required. Retain option for LEED projects.

C. Precast Concrete Double-Tee Beams Flange Section Removals:
1. Sawcut through top flange of specified double-tee beams on the fourth level for new drain installation. Sawcut with square edges. Overcutting is not permitted.
2. Specified removed sections of concrete shall be carefully collected, labeled and saved for Chloride Ion testing. Coordinate with Engineer, 4 samples to be collected in total. Reference section 1.08 of this specification
3. Cut concrete surfaces shall be treated with a corrosion inhibiting impregnation coating per the manufacturer’s instructions (specification 071900).
4. Existing welded wire fabric reinforcing in the top flanges to remain shall be coated with an epoxy touch up system per the manufacturer’s instructions. Apply 2 coats at manufacturer recommended thickness of self-priming epoxy paint system identified in products section of this specification.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

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

B. Burning: Do not burn demolished materials.

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

3.06 CLEANING

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

B. Reference Section 01700- Contract Closeout.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Concrete Removal will be measured for payment at the Contract unit price per square foot. Area limits not specifically identified on plans shall be confirmed with the Design Engineer prior to start of work.

B. The quantity of Double-Tee Beam Flange Section Removal shall be measured at the Contract unit price per each.

C. The quantity of Concrete Testing shall be measured at the Contract unit price per each.

D. The quantity for Pressure Washing of all surfaces to receive coatings/sealers shall be measured at the Contract unit price per square foot. This includes the 4th floor and Stairwells of the College Street Garage, and select areas at the Marketplace Garage as needed for work shown.

E. The quantity for Spandrel Beam Removal/Reattachment shall be measured at the Contract unit price per each.

F. The quantity for Beam Protective Fabric Wrap shall be measured at the Contract unit price per square foot

4.02 PAYMENT

A. The accepted quantity of Concrete Removal including preparation, removal, disposal, salvage, stockpiling, performing site restoration incidental to the removal of specified items, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
024119.01 (College St)	Square Foot
024119.02 (Marketplace)	Square Foot

B. The accepted quantity of Double-Tee Beam Flange Section Removal including preparation, removal, disposal, salvage, stockpiling, transport, application of corrosion inhibiting impregnation coating, application of epoxy paint to reinforcing steel, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
024119.11	Each

C. The accepted quantity of Concrete Testing (Chloride Ion) including preparation, disposal, stockpiling, transport, performing concrete testing and report summary, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
024119.12	Each

D. The accepted quantity of Pressure Washing including preparation, removal, disposal, performing site restoration incidental to the removal of specified items,

and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
024119.21	Square Foot

E. The accepted quantity of Spandrel Beam Removal/Reattachment including plan and calculations, traffic barrier, detachment of existing connections, lifting, storage, reattachment of existing beam connections, sealants, grouts, and all work incidental to the removal/reattachment of specified items, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
024119.31	Each

F. The accepted quantity of Beam Protective Wrap including fabric, fasteners and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
024119.41	Square Foot

END OF SECTION 024119

SECTION 024120

HYDRODEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of concrete spalls and/or patches as indicated on the plans by means of hydrodemolition.
B. Removal of joint sealant between adjacent flanges of double-tee beams as indicated on the plans by means of hydrodemolition.
C. Containment, collection, treatment and disposal of hydrodemolition wastewater and water used for clean-up.
D. Collection of debris from the demolition operation and disposal of all debris.

1.02 RELATED SECTIONS

A. Contract Drawings.
B. General Requirements
C. Section 012000 Traffic Control
D. Section 024119 Selective Demolition
E. Section 030130 Maintenance of Concrete
F. Section 079200 Joint Sealant

1.03 DEFINITIONS

A. Refer to Technical Specification Section 024119

1.04 MATERIALS OWNERSHIP

A. Refer to Technical Specification Section 024119

1.05 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.
Submit the following items:

1. Hydrodemolition equipment specifications. Include robot size and weight, supply water requirements, water consumption, and high-pressure hose specifications.
2. Location and layout of the hydrodemolition equipment.
3. Location and layout of the temporary water supply including materials to be used and any permits required to secure the use of the water.
4. Location and layout of any fuel system required for the equipment.
5. Location and layout of the system to be used to contain the wastewater including methods of reducing the suspended particles to acceptable levels, adjusting the pH, if required, and discharging the wastewater. Include any permits required to properly discharge the water.
6. Certification of the hydrodemolition operator's qualifications.
7. Clean-up equipment and method of removal for the debris from the concrete demolition. Include proposed drive lanes to move debris outside the structure such that the removal does not impact the ongoing operations.

1.06 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

B. Contractor shall employ a firm that have successfully performed at least five verifiable projects similar to this project within the last five years.

1. Work shall be under the immediate control of a person experienced in hydrodemolition who has supervised three verifiable projects of similar type and size. Supervising person shall be present during all operations.
2. An individual trained and certified in the proper use and safety of the equipment and having a minimum of two years experience with the equipment on jobs of similar type and size shall operate the hydrodemolition system.
3. Wastewater shall be tested, as required, to insure compliance with the wastewater discharge requirements established by the governing authority.
4. All water used for hydrodemolition and final clean up shall be potable.

PART 2 PRODUCTS

2.01 HYDRODEMOLITION EQUIPMENT

A. Concrete and joint sealant removal shall be performed with engineer approved high-pressure hydrodemolition equipment. Equipment shall be capable of removing concrete to the depth specified on the drawings and shall be capable of removing rust and laitance from exposed reinforcement designated to remain in place. The equipment shall be capable of removing concrete to within one inch of vertical surfaces.

2.02 CLEAN-UP EQUIPMENT

A. Clean-up equipment shall be of sufficient size and capacity to collect all debris from the hydrodemolition operation no latter then two hours following the hydrodemolition operation. The equipment shall be capable of removing wet debris and water. Water collected during the clean-up operation shall be discharged to the Contractor's wastewater collection system.

2.03 SUPPLY WATER

A. The Contractor shall arrange and coordinate the location from which the Contractor shall obtain potable water. The Contractor is responsible for supplying all material, equipment and tools necessary to tap into the water source. The Contractor shall install a meter to measure the water consumption.

PART 3 EXECUTION

3.01 GENERAL

A. The requirement of Technical Specification Section 024119 Part 3 apply to this section.

3.02 WASTEWATER CONTAINMENT AND DISPOSAL

A. Wastewater containment shall be the sole responsibility of the Contractor. All equipment needed, including piping, pumps, hoses and settling areas required for the proper collection, clean up and disposal of wastewater from the work area shall be provided and

maintained by the Contractor. The system shall be designed by the Contractor and approved by the engineer to meet the discharge requirements of the local governing authority.

B. The Contractor shall obtain any permits required for the discharge of the wastewater.

C. All wastewater generated by the Contractor's operations including hydrodemolition and clean up water must be contained by the Contractor and must pass through the Contractor's approved collection system. No water will be allowed to flow directly into the drainage system of the garage.

D. The Contractor shall establish and maintain any testing program required by the local governing authority for the wastewater discharge.

E. The Contractor shall remove daily from the site all concrete debris, sludge and other materials generated by his work and legally dispose of all such materials. See the requirement of Technical Specification Section 024119 Part 3 for additional information on disposal of materials.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Removal of concrete spalls and or patches shall be incidental to other items.

B. Removal of joint sealant shall be incidental to other items.

4.02 PAYMENT

A. Payment for removal of concrete spalls and or patches by hydrodemolition including preparation, removal, disposal and furnishing all labors, tools equipment, and incidentals necessary to complete the work shall be incidental to other items.

B. Payment for removal of joint sealant by hydrodemolition including preparation, removal, disposal and furnishing all labors, tools equipment, and incidentals necessary to complete the work shall be incidental to other items.

END OF SECTION 024120

SECTION 030130

MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.02 SECTION INCLUDES

A. This section describes the patching and crack repair of horizontal surfaces and vertical and overhead surfaces.

B. Repair existing concrete as shown in the Contract Drawings.
   1. Rout and seal concrete cracks in tops of precast concrete double tee beams to be repaired with crack healer-sealer and joint sealant.
   2. Remove deteriorated concrete and subsequently patch with non-shrink cementitious grout.
   3. Remove deteriorated concrete, clean reinforcing steel, install galvanic anodes and subsequently patch with non-shrink cementitious grout.

1.03 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-in-place Concrete.

C. Section 079200 – Joint Sealant.

D. Section 071900 – Water Repellants

E. General Requirements.

1.04 REFERENCES

A. ASTM International (ASTM):

Repair Mortar:
1. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. Cube Specimens).
3. C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
4. C191 – Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
5. C348 – Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
6. C496 – Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
7. C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing (Procedure A).
8. C672 – Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

9. C928 – Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for concrete repairs.
10. C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

Grout:
1. C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
2. C1107 - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Nonshrink).

B. Galvanic Anodes:
1. ACI/IRCI Concrete Repair Manual
2. ACI Guideline No. 222 – Corrosion of Metals in Concrete
3. ACI 562-13 Code Requirements for Evaluation, Repair and Rehabilitation of Concrete Buildings
4. ACI Repair Application Procedure (RAP) Bulletin 8 – Installation of Embedded Galvanic Anodes (2010)
5. ICRI Guideline 310.1R-2008 Guide for surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion
6. ASTM B418-12 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes

1.05 SUBMITTALS

A. General: Submit in accordance with Section 01300 – Submittals.

B. Product Data: Submit Manufacturer's product literature and installation instructions. Literature to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

C. Galvanized Anode Manufacturer Extended Limited Warranty

1. Contractor shall provide a Limited Warranty with a notarized signature from a corporate officer of the anode manufacturer.
2. The Limited Warranty shall state the following:
   a. The published anode spacing guidelines for anodes size and spacing are based on an estimated 10-20 year anode service life.
   b. The galvanic anodes will remain electrochemically active and produce galvanic current in relation to the environment in which it is installed for a minimum of 5 years from the date of anode installation.
   c. The anode unit, including its' constitutes, does not include intentionally added substances that may cause corrosion to reinforcing steel over the life of the structure.
   d. The galvanic anodes meet all building and repair code requirements.

1.06 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

1.07 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing products specified in this Section with minimum of five years documented experience. The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis

B. Contractor:
   1. Minimum three years documented experience in Work of this Section and approved by Manufacturer. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Manufacturer Corrosion Technician
   1. The contractor will enlist and pay for a technical representative employed by the galvanic anode manufacturer to provide training and on-site technical assistance during the initial installation of the galvanic anodes. The technical representative shall be a NACE-qualified corrosion technician (Cathodic Protection Technician–CP2 or higher).
   2. The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic protection systems for reinforced concrete structures.
   3. The contractor shall coordinate its work with the designated corrosion technician to allow for site support during project startup and initial anode installation. The corrosion technician shall provide contractor training and support for development of application procedures, verification of electrical continuity, and project documentation.

1.08 DELIVERY, STORAGE AND HANDLING

A. Reference Section – 01500 Construction Facilities and Temporary Controls.

B. Deliver materials to the project site in original, factory sealed, unopened containers/packages bearing the Manufacturer's name and label intact and legible with the following information:
   1. Name of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Material safety data sheet.

C. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

D. Reference Section 01600 – Material and Equipment.

1.09 WARRANTY

A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with the dated of substantial completion of the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

4.02.1.1.1 Source Limitations: For repair products, obtain each color, grade finish, type and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.02 LOW VISCOSITY CRACK HEALER/SEALER

A. Sikadur 55 SLV
B. Euclid Dural 335
C. Or Approved Equal

2.04 BONDING AGENTS

A. Follow Manufacturer's Recommendations.

B. Mortar Scrub Coat: Mix consisting of 1 part Portland cement and 1 part fine aggregate complying with ASTM C 144 except 100 percent passing a No. 16 (1.18 mm) sieve. For use at non-product specific repair locations only.

2.05 NON-SHRINK CEMENTITIOUS GROUT FOR HORIZONTAL REPAIR

A. Master Emaco T430
B. Sika MonoTop 615
C. Euclid Express Repair
D. Or Approved Equal.

2.06 NON-SHRINK CEMENTITIOUS GROUT FOR VERTICAL OR OVERHEAD REPAIR

A. SikaTop 123
B. Master Emaco W 1501 HCR
C. Euclid Dural Top Gel
D. Or Approved Equal.

2.07 EMBEDDED GALVANIC ANODES

A. Embedded galvanic anodes shall be Anode Type 1A Class P with the following nominal dimensions: 2.6 in. diameter by 1.2 in. deep (65 mm diameter by 30 mm). The anodes shall be pre-manufactured with a nominal 60 grams of zinc in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater.

B. The galvanic anodes shall be alkali-activated and shall contain no intentionally added chloride, bromide or other constituents that are corrosive to reinforcing steel as per ACT 562-13. Anode units shall be supplied with integral unspliced wires for directly tying to the reinforcing steel. Galvanic anode shall be:

1. Galvashield XP from Vector Corrosion Technologies
2. Or approved equal.

C. Application for approved equals shall be requested in writing two weeks following Notice of Award. Application for galvanic anode approved equals shall include verification of the following information:
1. The zinc anode is alkali-activated with an alkaline cementitious shell with a pH of 14 or greater.
2. The galvanic anode shall contain no intentionally added constituents corrosive to reinforcing steel, e.g. chloride, bromide, etc.
3. The anode manufacturer shall provide documented test results from field installations showing that the anodes have achieved a minimum of 10 years in service.
4. The galvanic anode shall have been used in a minimum of ten projects of similar size and application.
5. The galvanic anode units shall be supplied with solid zinc core (ASTM B418) cast around uncoated, non-galvanized, non-spliced steel tie wires for wrapping around the reinforcing steel and twisting to provide a durable steel to steel connection between the tie wire and the reinforcing steel.
6. The anode manufacturer shall provide third party product evaluation, such as from Concrete Innovations Appraisal Service, BBA, etc.

2.08 EPOXY PAINT

A. See Technical Specification Section 024119 Part 2 for approved products.

2.09 STEEL REINFORCEMENT

A. See Technical Specification Section 033000 Part 2 for product specifications and information.

PART 3 EXECUTION

3.01 PREPARATION

A. Rout and Seal Concrete Cracks in Precast. Concrete double-tee beams for Joint Sealant Installation.
1. Prepare groove at the surface that is ⅛" - ¼" wide and a minimum of ¼" deep utilizing a concrete saw, hand tools, or pneumatic tools.
2. Clean groove by air blasting, sandblasting, or water blasting, and dry.
3. See joint sealant specification Section 079200 for additional preparation procedures.

B. Concrete Removal
1. Prepare repair area by removal of all deteriorated concrete to a minimum depth of ½" or to sound concrete or to limits shown on the plans. Repair areas shall be established jointly by Engineer and Contractor.
2. Use of chipping hammers heavier than nominal 15 pound class are not permitted.
3. Square cut all repair area edges. Feathered removal edges will not be permitted.

4. Follow Manufacturer's instruction for surface preparation.

C. Cleaning Reinforcing Steel (For Galvanic Anode Installation)
1. Clean exposed reinforcing steel of rust, mortar, etc. to provide sufficient electrical connection and mechanical bond.
2. Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.
3. Verify electrical continuity of all reinforcing steel, including supplemental steel, as per Section 3.01-D6.

3.02 INSTALLATION

A. Crack Repair
1. Apply crack healer-sealer per Manufacturer's instructions.
2. Install joint sealant. See Specification Section 079200 for products and installation procedures.

B. Non-Shrink Cementitious Grout
1. Follow Manufacturer's instructions for installation procedures.
2. Apply scrub coat on dampened existing concrete surfaces.
3. For patches deeper than 1" extend with thoroughly washed, dry, sound, non-ASR reactive aggregate per manufacturer's instructions.

C. Galvanic Anode Installation
1. Install anode units and repair material immediately following preparation and cleaning of the steel reinforcement.
2. Galvanic anodes shall be installed attached to the exposed reinforcing steel at a minimum of one per spall patch repair or a spacing of 18" max o.c. in larger repair locations
3. Place the galvanic anodes such that the groove fits along a single bar or the intersection of 2 bars and secure to each clean bar, allowing the repair material to fully encase the anode and rebar, with a minimum concrete cover over the anode of 1 in. (25mm).
   a. If less than 1 in of cover is expected, place the anode beneath the bar and secure to clean reinforcing steel.
4. The tie wires shall be wrapped around the cleaned reinforcing steel at least one full turn in opposite directions and then twisted tight to create a secure electrical connection and allow no anode movement during concrete placement.
5. If repair materials with resistivity greater than 15,000 ohm-cm are to be used or if the resistivity is unknown, pack Galvashield Embedding Mortar between the anode and the substrate concrete to create a conductive grout bridge ensuring no voids exist. If anodes are to be used in cast-in-place concrete areas, Contractor shall provide test results of the resistivity of the mix design or assume it is greater than 15,000 ohm-cm.
6. Electrical Continuity
   a. Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm Ω) or DC potential (mV) with a multi-meter.
   b. Electrical connection is acceptable if the DC resistance measured with the multi-meter is 1 Ω or less or the DC potential is 1 mV or less.

c. Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established by tying discontinuous steel to continuous steel using steel tie wire.

d. Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is 1 Ω or less or the potential is 1 mV or less.

3.03 PROTECTION

A. Reference Section 01500 – Construction facilities and Temporary Controls.

B. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified materials

3.04 CURING

A. Grout

1. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the Manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.05 CLEANING

A. Reference Section 01700 – Contract Closeout.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Rout and Seal Concrete Crack for 079200 Joint Sealant will be measured for payment at the Contract unit price per linear foot.

B. The quantity of Double-Tee Flange Connector Patch Repair will be measured for payment at the Contract unit price per each.

C. The quantity of Horizontal Concrete Patch Repair, Type I will be measured for payment at the Contract unit price per square foot.

D. The quantity of Horizontal Concrete Patch Repair, Type II will be measured for payment at the Contract unit price per square foot.

E. The quantity of Vertical Concrete Patch Repair will be measured for payment at the Contract unit price per square foot.

F. The quantity of Cathodic Protection will be measured for payment at the contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of Rout and Seal Concrete Crack including full compensation for routing, preparing and sealing the crack line and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
030130.01 (College St)	Linear Foot
030130.02 (Marketplace)	Linear Foot

B. The accepted quantity of Double-tee Flange Connector Patch Repair including full compensation for performing the work specified, including removal of shear tab plate, wire brush and epoxy paint plates to remain as detailed in Contract Documents, sawcutting, removal of deteriorated concrete, surface preparation as specified, installation of grout patch, satisfactory completion of curing, and the furnishing of all forms, materials, including labor, tools, admixtures, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
030130.11	Each

C. The accepted quantity of Horizontal Concrete Patch Repair Type I including full compensation for performing the work specified, including sawcutting, removal of deteriorated concrete to a depth from the surface of existing concrete to a maximum depth as determined by the top of the top bars of the top mat of existing reinforcing steel, surface preparation as specified, installation of grout patch, satisfactory completion of curing, and the furnishing of all forms, materials, including labor, tools, admixtures, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
030130.21	Square Foot

D. The accepted quantity of Horizontal Concrete Patch Repair Type II including full compensation for performing the work specified, including sawcutting, removal of deteriorated concrete to a depth from the surface of the existing concrete to a minimum depth of ¾" +/- ¼" below the bottom bars of the top mat of reinforcing steel, surface preparation as specified, installation of grout patch, satisfactory completion of curing, and the furnishing of all forms, materials, including labor, tools, admixtures, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
030130.22 (College St)	Square Foot
030130.23 (Marketplace)	Square Foot

E. The accepted quantity of Vertical Concrete Patch Repair Type I including full compensation for performing the work specified, including sawcutting,

removal of deteriorated concrete, surface preparation as specified, installation of grout patch, satisfactory completion of curing, and the furnishing of all forms, materials, including labor, tools, admixtures, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
030130.31	Square Foot

F. The accepted quantity of Cathodic Protection including full compensation for performing the work specified, including reinforcing steel cleaning and furnishing of all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
030130.42 (Marketplace)	Each

END OF SECTION 030130

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place (C.I.P.) concrete for concrete repairs as shown in the Contract Drawings.
   1. C.I.P. concrete for the new drain installations, and miscellaneous repair locations as identified on the contract drawings.
   2. C.I.P. concrete for the C.I.P. concrete wash area replacement areas.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 071000 – Waterproofing Membrane.

C. Section 071900 – Water Repellents

D. Section 079200 – Joint Sealants.

E. Section 321313 – Concrete Pavement.

F. General Requirements.

1.03 REFERENCES

A. American Concrete Institute (ACI)
   1. 117 – Specification for Tolerances for Concrete Construction and Materials
   2. 212 – Admixtures for Concrete
   3. 301 – Standard Specification for Structural Concrete.
   4. 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   5. 305R – Guide to Hot Weather Concreting.
   6. 306R – Guide to Cold Weather Concreting.
   7. 308 – Guide to Curing Concrete.
   8. 309 – Guide for Consolidation of Concrete.
   9. 318 – Building Code Requirements for Structural Concrete.

B. ASTM International (ASTM)
   1. C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. C33 – Standard Specification for Concrete Aggregates.
   3. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. C94 – Standard Specification for Ready-Mixed Concrete.
   5. C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   6. C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
   7. C150 – Standard Specification for Portland Cement.

8. C171 – Standard Specification for Sheet Materials for Curing Concrete.
9. C172 – Standard Practice for Sampling Freshly Mixed Concrete.
10. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. C260 – Standard Specification for Air Entraining Admixtures for Concrete.
12. C295 – Standard Guide for Petrographic Examination of Aggregates for Concrete.
13. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. C330 – Standard Specification for Lightweight Aggregates for Structural Concrete.
15. C494 – Standard Specification for Chemical Admixtures for Concrete.
16. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. C1064 - Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
18. C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
19. D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
20. D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
21. D1752 – Standard Specification for Preformed Sponge Rubber and Cork and Recycled Expansion Joint Fillers for Concrete Paving and Structural Construction.
22. D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.

B. Concrete design mixes, material test results, and results of strength tests from the trial concrete mixes by the Contractor's testing laboratory firm.

C. Material certificates: For each of the following signed by Manufactures:
   1. Cementitious Materials
   2. Admixtures

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements.
   1. Aggregates. Include Alkali-Silica Reactivity (ASR) AASHTO T303 Modified. The modification shall be run using the proposed job cementitious material proportioning with the aggregate found to have the highest ASR potential. The expansion shall be below 0.10%.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Facilities."

D. Testing Agency Qualifications: An independent agency qualified to according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

E. ACI Publications: Comply with the following:
   1. ACI 301
   2. ACI 117

F. Maintain one copy of each document on site.

G. Acquire cement and aggregate from one source for Work.

H. Conform to ACI 305R when concreting during hot weather.

I. Conform to ACI 306R when concreting during cold weather.

J. Materials and installed work may require testing and retesting at any time during progress of work. Retesting of rejected materials for installed work shall be done at the Contractor's expense.

K. Do not use admixtures such as calcium chloride that will cause accelerated setting of the cement in concrete.

L. The Contractor is responsible for employing an independent accredited testing laboratory, acceptable to the Design Engineer and Owner.

M. Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance, and strength as specified and indicated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Reference Section – 01500 Construction Facilities and Temporary Controls.

B. Order concrete from batching plant so that trucks arrive at discharge locations when the concrete is required. Avoid excessive mixing of concrete or delays in placing successive layers of concrete in forms.

C. The concrete supplier shall deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water-cement ratio, slump, air-entrainment, temperature and homogenity.

D. Deliver concrete in order that the contractor can accept delivery within 90 minutes after batching or earlier during hot weather concreting as specified. Do not add retempering water, nor exceed the specified water-cement ratio.
   1. The addition of water in excess if the design water-cementitious material ratio for purposes of meeting the slump limits will not be permitted. Concrete that is not within the specified slump or water/cementitious limits at time of placement shall not be used.

E. The Contractor or Design Engineer shall reject concrete not conforming to specification, unsuitable for placement, exceeding time limitation restraints, and not having a complete delivery batch ticket.

F. Use all means necessary to protect the materials of this division before, during and after installation and to protect the installed work and materials of other trades.

G. Replacements: In the event of damage, immediately make all repairs and replacements to the approval of the Design Engineer and at no additional cost to the Owner.

1.07 PROJECT CONDITIONS

A. Do not place concrete until conditions and facilities for making and curing control test specimens are in compliance with ASTM C31.

1.08 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

B. Coordinate blockouts when required for product installations (i.e. expansion joint systems).

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I/II, Portland Cement, free of lumps. Use one approved brand of uniform colored cement from one mill throughout project unless otherwise approved by the Design Engineer. Reject entire shipment when cement is lumpy, wetted, partially or wholly set. Provide cement without efflorescence when tested in accordance with ASTM C67.

B. Fly Ash: ASTM C618 Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C989, Grade 100.

D. Silica Fume: ASTM C1240, Amorphous Silica.

E. Fine and Coarse Aggregates:
   1. Fine: ASTM 33, clean, hard, durable, uncoated natural sand, free from silt, loam, and clay.
   2. Coarse: ASTM 33, clean, hard, durable, uncoated crushed stone, maximum aggregate size 3/8".

F. Elastomeric Bearings:
   1. See requirements of Technical Specification section 03 4200.

2.02 ACCESSORIES

A. Water: ASTM C94/C 94M, Clean and potable.

B. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water reducing or water reducing/set retarding: ASTM C494, Type A or D.
   2. Air entraining: ASTM C260.

C. Bonding Agent: Mix consisting of 1 part Portland cement and 1 part fine aggregate complying with ASTM C 144 except 100 percent passing a No. 16 (1.18 mm) sieve.

D. Curing Compound: ASTM C309, Type 1, Class B dissipating.
   1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to the following:
      a. Dayton Superior Corp; Clear Dissipating Cure EF
      b. Vexcon Chemicals, Inc.; Harris Kurseal 800 White
      c. W.R. Meadows of PA; SEALTIGHT 1100 – Clear Concrete Curing Compound
      d. Or Approved Equal

E. Curing Paper: ASTM C 171, waterproof paper or polyethylene film.

2.03 CONCRETE MIX

A. Concrete Mix shall meet the requirements of Vermont Agency of Transportation (VTrans) high performance concrete Type AA per VTrans Specification Section 501.

2.04 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.
B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain deformed steel.

2.05 REINFORCEMENT ACCESSORIES

A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

PART 3 EXECUTION

3.01 EXAMINATION

A. When applicable, verify dimensions of blockout for the expansion joint system.

B. When applicable, verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with 2.02 C instructions. Do not damage exposed concrete edges, key grooves, or reinforcement.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 and ACI 318.

B. Whenever possible, place concrete during normal working hours. When concrete placement schedules require concrete placement at times other than normal working hours, notify Design Engineer of special conditions at least 48 hours in advance of placement.

C. Notify Design Engineer minimum 48 hours prior to commencement of concrete placement operations. Include within this notification, the quantity of concrete, method and placement location, frequency of trucks, ordered slump and time of initial delivery.

D. Provide a delivery batch ticket to the Design Engineer’s field representative, written in ink or computer printed, with each batch delivered to the discharge location, and as specified in ASTM C94 and in addition, state the following:
   1. Load number, truck number and driver’s name
   2. Compression strength of concrete
   3. Amount of concrete (Cubic Yards)
   4. Time truck is charged with cement
   5. Reading of revolution counter at first addition of water
   6. Type, brand and amount of cement
   7. Type, brand and amount of admixture
   8. Information necessary to calculate total mixing water

9. Maximum size of aggregate
10. Weights of fine and coarse aggregates
11. Signature of ready-mix representative

E. Clean embedded items of oil and all foreign matter.

F. Ensure reinforcement, inserts, embedded parts, and construction joints, are not disturbed during concrete placement.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Place concrete continuously between predetermined construction joints.

I. Discharge concrete into forms within 90 minutes after cement was entered into mixing drums or before the drum has revolved 300 revolutions after the addition of water, whichever comes first. Do not add retempering water at the job site, nor exceed the maximum water content specified herein.

J. The temperature of the concrete just prior to placement in the forms shall be between 10 and 27 °C (50 and 80 °F). Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits.
   1. No concrete shall be placed when the ambient air temperature is, or is expected to be, above 29 °C (85 °F) during placement except with written permission of the Design Engineer.
   2. No concrete shall be placed when the temperature of the surrounding atmosphere is lower than - 12 °C (10 °F) except by written permission of the Design Engineer.

K. Do not interrupt successive placement; do not permit cold joints to occur.

L. Deposit concrete at its final position in formwork, to preserve slump, air content, and homogeneity in accordance with ACI 304, and as specified herein.

M. Do not deposit partially hardened concrete in forms. Retempering of partially hardened concrete is prohibited. Remove all partially hardened concrete from site at no additional compensation.

N. Do not allow concrete to fall freely in forms to cause segregation. Do not move concrete horizontally more than four feet from the point of discharge. Space points of deposit not more than eight feet apart.

O. Do not pump concrete through aluminum piping.

P. Use piping at least three times the size of the maximum aggregate size.

Q. Consolidate concrete in accordance with ACI 309.

R. See Section 1.06 for additional requirements.

3.04 CONCRETE FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301.

B. For steel trowel surfaces which are indicated to be exposed apply a light broom finish to areas that will see pedestrian traffic.

C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

D. Place control joints every 20 feet, and around all structures adjacent to poured concrete.

3.05 PROTECTION

A. Reference Section 01500 – Construction Facilities and Temporary Controls.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Provide artificial heat to maintain temperature of concrete above minimum specified temperature for duration of curing period.

E. Keep forms sufficiently wet to prevent cracking of concrete or loosening of form joints.

3.06 CURING

A. Cure concrete in accordance with ACI 308.1, by one or a combination of the following methods:

B. Curing Compounds:
   1. Must meet the requirements of 2.02 D.
   2. Are required to be approved by the waterproofing membrane Manufacturer's Representative.

C. Wet Curing Method:
   1. Spray water over surfaces and maintain wet for 7 days.
   2. Restrict traffic on surfaces during curing.

3.07 CLEANING

A. Remove efflorescence, stains, oil, grease, and foreign materials from exposed surfaces.

B. Section 01700 – Contract Closeout.

3.08 FIELD QUALITY CONTROL

A. Reject concrete delivered without a complete concrete delivery batch ticket as specified. Copies of the signed batch ticket will be furnished by the concrete supplier to the Contractor and Design Engineer.

B. Inspect the concrete transit truck's barrel revolution counter and gauge for measuring water added to the concrete.

C. Reject concrete which exceeds the maximum barrel revolution of 300 or which has had water added during transit.

D. Reject concrete exceeding specified time limitations.

E. Reject concrete exceeding specified water to cementitious material ratio.

F. Concrete not conforming to these Specifications shall be rejected by the Contractor or the Design Engineer before discharging into the forms.

G. Test Cylinders:
   1. Make test cylinders in accordance with ASTM C172; one set of 3 cylinders for each 100 cubic yards or fraction thereof placed in any one day.
   2. Mold and cure cylinders in accordance with ASTM C31; test cylinders in accordance with ASTM C39; one at 7 days and two at 28 days.

H. Testing at Discharge:
   1. The Contractor's testing laboratory firm, if required, will use concrete samples, provided by the Contractor at the point of truck discharge to perform slump, air content, and temperature tests for field control test specimens. The testing laboratory firm will take measurements of slump, air content, and temperature not less than once per day, nor less than once per 50 cubic yards of concrete. Tests measurements shall be in accordance with ASTM C143, ASTM C231, and ASTM C1064, respectively.
   2. The testing laboratory firm will immediately submit test reports of concrete field measurements sampled above to the Contractor and the Design Engineer.
   3. Accept or reject concrete on the basis of conformity with the Specifications contained herein for slump, air content and temperature.
   4. Reject concrete in excess of 90 degrees F.

I. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

J. Air Content: ASTM C231, pressure method for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

K. Concrete Temperature: ASTM C 1064/C 1064M; on test hourly when air temperature is 40 deg F (4.4 dec C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

3.09 PATCHING

A. Allow Design Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Design Engineer immediately upon discovery.

C. Patch imperfections as directed by Design Engineer in accordance with ACI 301.

D. Core holes shall be roughened, cleaned and dampened. Fill core holes with 4000 psi (minimum) concrete and wet cure for 7 days after placement.

3.010 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Design Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Design Engineer for each individual area.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Cast-In-Place Concrete will be measured for payment at the Contract unit price per cubic yard.

B. The quantity of Level 2 Bearing Repair will be measured for payment at the Contract unit price of lump sum.

C. The quantity of Reinforcing Steel will be measured for payment at the Contract unit price per pound.

4.02 PAYMENT

A. The accepted quantity of Cast-In-Place Concrete including full compensation for performing the work specified, including designing the mix, satisfactory finishing and curing, and for furnishing all forms, materials, including joint filler and bonding agent, labor, tools, admixtures, equipment, including automatic temperature recording units, trial batches, the cost of heating materials and protecting against the cold weather, the cost of furnishing testing facilities and supplies at the batch plant, curing and incidentals necessary to complete the work will be paid for at the Contract unit price per cubic yard.

Pay Item	Pay Unit
033000.01	Cubic Yard

B. The accepted quantity of Level 2 Bearing Repair including full compensation for performing the work specified, including sawcutting, removal of unsound concrete, jacking and shoring of existing beam, surface preparation, designing the mix, satisfactory finishing and curing, and for furnishing all forms, materials, including joint filler, elastomeric bearings and bonding agent, labor, tools,

admixtures, equipment, including automatic temperature recording units, trial batches, the cost of heating materials and protecting against the cold weather, the cost of furnishing testing facilities and supplies at the batch plant, curing and incidentals necessary to complete the work will be paid for at the Contract unit price per lump sum.

Pay Item	Pay Unit
033000.11	Lump Sum

C. The accepted quantity of Reinforcing Steel including full compensation for performing the work specified, including cutting, bending, and epoxy paint touch up as applicable and incidentals necessary to complete the work will be paid for at the Contract unit price per pound.

Pay Item	Pay Unit
033000.21	Pound

END OF SECTION 033000

SECTION 034200

ELASTOMERIC BEARING PADS

PART I GENERAL

1.01 SECTION INCLUDES

A. Installation of new elastomeric bearings pads for select precast concrete double-tee beams as shown in the Contract Drawings.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-In-Place Concrete

C. General Requirements.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M251 Plain and Laminated Elastomeric Bridge Bearings

B. American Society for Testing and Materials (ASTM):
   1. D395 – Standard Test Method for Rubber Property – Compression Set.
   2. D412 – Standard Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers.
   3. D429 – Standard Test Method for Rubber Property – Adhesion to Rigid Substrates.
   4. D518 – Standard Test Method for Rubber Deterioration – Surface Cracking.
   5. D573 – Standard Test method for Rubber – Deterioration in Air Oven.
   6. D1149 – Standard Test Method for Rubber Deterioration – Surface Ozone Cracking in a Chamber.
   7. D2240 – Standard Test Method for Rubber Property – Durometer Hardness.
   8. D4014 – Standard Specification for Plain and Steel-Laminated Elastomeric Bearings for Bridges.

1.04 DEFINITIONS

A. As used in these Specifications, the word “elastomer” or “elastomeric” means “rubber”, the words are interchangeable.

1.05 SUBMITTALS

A. General: Submit in accordance with Section 01300 – Submittals.

B. Product Data: Submit Manufacturer’s product literature and installation instructions.

1.06 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

PART 2 PRODUCTS

2.01 MATERIALS

A. Elastomeric Compound/Elastomer: Virgin crystallization resistant polychloroprene (neoprene) or virgin natural polyisoprene (natural rubber) as the raw polymer. The resulting product shall be free of porous areas, weak sections, bubbles, foreign matter, or other defects affecting serviceability. Grade (Durometer) 60 +-5 measured on ASTM D2240 – Durometer Hardness.

B. Adhesive: Adhesive for the installation of bearing pads to concrete shall be a solvent-free adhesive as appropriate for this particular installation.

2.02 FABRICATION

A. Plain elastomeric pads shall be molded individually, or cut from previously molded strips or slabs, or extruded and cut to size. Cutting shall produce a smooth surface. No heating of the elastomer is permitted.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean existing beam bearing surface.

3.02 INSTALLATION

A. Install elastomeric bearing pads as shown in the Contract Drawings in accordance with the provided details.

B. Apply adhesive to clean bearing surface to a minimum thickness of 1/8 inch, and set bearing pads on adhesive bed as indicated.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Incidental to other pay items

4.02 PAYMENT

A. Incidental to other pay items.

END OF SECTION 034200

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Replacement of Damaged Clay Facing Brick.

B. Replacement of Damaged Concrete Block.

C. Mortar.

D. Reinforcement and Anchorage.

E. Flashings.

F. Accessories.

1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2013.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2012.

1.03 SUBMITTALS

A. See Division 1, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit two samples of facing brick units to illustrate color, texture, and extremes of color range.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and texture: To match existing.
   2. Nominal size: To match existing.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
   4. Compressive strength: To match existing, measured in accordance with ASTM C67.

2. 02 CONCRETE BLOCK:

A. Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depths as indicated on the drawings for specific locations.

2. Load-Bearing Units: ASTM C90, normal weight.

a. Exposed Faces: Special color and texture where indicated

3. Non-Loadbearing Units: ASTM C129.

a. Hollow block, as indicated.

4. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.

a. Performance of Units with Integral Water Repellent:

1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.

(a) No water visible on back of wall above flashing at the end of 24 hours.

(b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.

(c) No more than 25% of wall area above flashing visibly damp at end of test.

2) Flexural Bond Strength: ASTM C1357; minimum 10% increase.

3) Compressive Strength: ASTM C1314; maximum 5% decrease.

4) Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.

a. Use only in combination with mortar and grout that also has integral water repellent admixture.

b. Use water repellent admixtures for masonry units, mortar and grout by a single manufacturer.

2.03 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

A. To match existing.

B. Steel framing and supports including galvanized loose lintels.

1. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

2. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

a. Furnish inserts if units are installed after concrete is placed.

3. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

4. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.05 FLASHINGS

A. Repair existing flashing damaged by construction. Replace any flashing which cannot be fully repaired with material and profile to match existing.

2.06 ACCESSORIES

A. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; maximum lengths available.

B. Joint Sealant: Silicone; ASTM C920, Type S, Grade NS, Class 100.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N and as required to match existing.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Color to match existing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

3.02 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.04 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry as directed.

D. Mortar Mix: Colored and proportioned to match existing work.

E. Ensure that anchors are correctly located and built in.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:
   1. Bond and Coursing: To match existing.
   2. Mortar Joints: To match existing.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

F. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Maintain existing reinforcement and anchorage. Repair where damaged by construction. Replace sections of reinforcement and anchorage and tie to existing, where full repair is not possible.

3.08 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Lap end joints of flashings at least 6 inches and seal watertight with flashing sealant/adhesive.

3.09 FINISHES

A. Paint brick to match existing where existing brick is painted.
Color to match existing.
Repaint to extent that there is no obvious line of affected repainted area.

3.09 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.10 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.11 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of brick replacement will be measured for payment at the Contract unit price per square foot.

4.02 PAYMENT

A. The accepted quantity of brick replacement including full compensation for performing the work specified, including brick, mortar, flashing, sealants, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, the cost of heating materials and protecting against the cold weather, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
04 2000.01 Brick façade and Block repair / replacement	Square Foot
04 2000.02 Replace Metal Coping	Square Foot

END OF SECTION

SECTION 058000

METAL DETAILS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal, modification, rehabilitation and reinstallation with stainless steel bolts of concrete filled steel pipe bollards as identified on the Drawings.

B. Reattachment of stair treads as identified on the Drawings.

C. Installation of stainless steel drain pipe guards as identified on the Drawings.

1.02 SUMMARY

A. Related Sections.
   1. Section 024119 – Selective Demolition.

1.03 REFERENCES

A. ASTM International (ASTM)
   1. ASTM A36 – Standard Specification for Carbon Structural Steel.
   2. ASTM A480 – General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
   3. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   4. ASTM D1654 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
   5. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

B. American Welding Society
   1. AWS D1.1 Structural Welding Code - Steel.

C. SSPC - Steel Structures Painting Manual.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.

B. Steel Pipe Bollards:
   1. Rehabilitation plan for existing bollards including:
      a. Paint color samples and product data.
      b. Rehabilitation sequence.
   2. Product data for stainless steel bolts.

C. Stair Treads:
   1. Product data for stainless steel fasteners.
   2. Product data for mastic adhesive.

D. Stainless Steel Drain Pipe Guards:
1. Fabrication drawings indicating all dimensions, thicknesses and material properties.
2 Product data for stainless steel concrete screws.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1 Structural Welding Code – Steel.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Reference Section – 01500 Construction Facilities and Temporary Controls.

B. Protect all materials during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

A. High Strength Non-Shrink Grout:

1. Five Star Products, Inc. – Five Star Grout

2. BASF – MasterFlow 100

3. Dayton Superior – Sure-Grip High Performance Grout

B. Adhesive Mastic For Stair Treads:

1. Sikaflex 11 FC

2. Or approved equal

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's installation instructions and setting drawings.

B. Install components plumb and level, accurately fitted, free from distortion or defects.

C. Install mastic at stair tread reattachment in accordance with manufacturer's recommendations. At a minimum install around the perimeter of the stair tread assemblies (inset to avoid mastic leaking out when treads are set)

D. Do not apply mastic at reattached stair treads beyond the tread perimeter. If mastic squeezes out during installation onto exposed concrete, fully clean concrete surface prior to mastic set.

3.02 SHOP FINISHING

A. Prepare surfaces to be primed in accordance with SSPC.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Prime paint items with one coat.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Steel Pipe Bollard will be measured for payment at the Contract unit price per each.

B. The quantity for Stair Tread Reattachment will be measured for payment at the Contract unit price per each.

C. The quantity for Stainless Steel Drain Pipe Guard will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of Steel Pipe Bollards including full compensation for removal of existing bollards and; removal of existing base plate, cleaning, preparation, attachment of new base plate, repainting of bollard, re-installing using stainless steel bolts, and installation of high strength non-shrink grout including furnishing, handling, transporting of materials, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price each.

Pay Item	Pay Unit
058000.01	Each

B. The accepted quantity of Stair Tread Reattachment will include removal of existing stair treads and fasteners, surface preparation, adhesive application, stainless screw fasteners and installation, and including furnishing, handling, transporting of materials, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price each.

Pay Item	Pay Unit
058000.11	Each

C. The accepted quantity of Stainless Steel Drain Pipe Guard will include fabrication and installation with stainless steel concrete screws, and including furnishing, handling, transporting of materials, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price each.

Pay Item	Pay Unit
058000.21	Each

END OF SECTION 058000

SECTION 058010

CAST-IRON ADA DETECTABLE WARNING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnishing and installation of detectable waning surfaces on ramps as detailed on the plans.

1.02 SUMMARY

A. Related Sections.
   1. Contract Documents.
   2. Section 033000 – Cast-In-Place Concrete.

1.03 REFERENCES

A. 2010 ADA Standards for Accessible Design.

B. ASTM International (ASTM)
   1. A48/A 48M

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.

B. Submit product data for detectable warning devices.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Reference Section – 01500 Construction Facilities and Temporary Controls.

B. Protect detectable warning devices and accessories during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 CAST-IRON DETECTABLE WARNING DEVICES

A. Approved Manufacturers
   1. East Jordan Iron Works, Inc. East Jordan, Michigan.
   2. Neehan Foundry Company Neehan, Wisconsin.
   3. Or Approved Equal.

4.

B. Required Geometry:
   1. Detectable warning panels shall have truncated domes with a base diameter of nominal 0.9 in, a top diameter of nominal 0.4 in, height of nominal 0.2 in and a center to center spacing of 2.35 in.
   2. Domes shall be arranged in a grid pattern and shall align properly from panel to panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's installation instructions and setting drawings.

B. Use a combination of panel widths to cover the full ramp width. Field cutting panels is not permitted.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Cast-Iron ADA Detectable Warning Devices for full installation at a ramp will be measured for payment at the Contract unit price per each. Multiple panels may be required at each ramp. However, payment shall be per ramp completed.

4.02 PAYMENT

A. The accepted quantity of Cast-Iron ADA Detectable Warning Devices including full compensation for furnishing, handling, transporting of materials, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price square foot.

Pay Item	Pay Unit
058010.01	Square Foot

END OF SECTION 058010

SECTION 071800

WATERPROOFING MEMBRANE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waterproofing membrane to be installed above the C.I.P. wash areas and at locations as shown in the Contract Drawings.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-in-place Concrete.

C. Section 079200 – Joint Sealant.

D. General Requirements.

1.03 REFERENCES

A. ASTM International (ASTM):
   1. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
   2. D4259 - Standard Practice for Abrading Concrete.
   3. D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01300 - Submittals

B. Product Data: Submit Manufacturer's product literature and installation instructions.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

1.06 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing products specified in this Section with minimum of five years documented experience.

B. Contractor:
   1. Minimum three years documented experience in Work of this Section and approved by Manufacturer. Contractor shall maintain qualified personnel who have received product training by manufacturer's representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in original, factory sealed, unopened containers/packages bearing the Manufacturer's name and label intact and legible with the following information:
   2. Name of material.
   3. Manufacturer's stock number and date of manufacture.
   4. Material safety data sheet.

B. Reference Section 01600 – Material and Equipment.

C. Store materials at minimum 75 degrees F; prevent damage to containers. Do not store for long periods in direct sunlight.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply coating when surface temperature is less than 40 degrees F or if precipitation is imminent.
   2. Do not apply unless surfaces to receive coating are dry.

B. Regulatory Requirements:
   1. Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

C. Coordinate product compatibility with other products specified at application area.

PART 2 PRODUCTS

2.01 MATERIALS

A. Waterproofing Membrane:
   1. Primer: As recommended by coating system Manufacturer.
   2. Sheet flashing: Elastomeric material, as recommended by coating Manufacturer.
   3. Aggregate: Natural or manufactured sand, uniformly graded, minimum 6.5 hardness on Moh's scale.
   4. Coating: Polyurethane, color gray.
   5. Joint sealer: As recommended by coating system Manufacturer.
   6. Extra Heavy Duty application per Manufacturer's instructions.

2.02 MANUFACTURERS

A. Waterproofing Membrane:
   1. Sika Duochem 390/391/394 Traffic System
   2. MasterSeal Traffic 1500 Deck Coating System
   3. Or approved equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Before any waterproofing work is started the waterproofing applicator shall thoroughly examine all surfaces for any deficiencies. Should any deficiencies exist, the Design Engineer, Owner, or Contractor shall be notified in writing and corrections made.

B. Condition of Concrete Surfaces:
   1. The concrete surfaces shall be of sound structural grade and shall have a smooth finish, free of fins, ridges, voids or entrained air holes. Rough surfaces shall receive a well adhered parget coat.
   2. Concrete shall be cured by water curing method. Any curing compounds must be of the pure sodium silicate type and be approved by the Manufacturer's representative.
   3. Concrete shall be cured at least 7 days and shall be sloped for proper drainage.
   4. Line striping of concrete shall be completed prior to application of waterproofing.
   5. Voids, rock pockets and excessively rough surfaces shall be repaired with approved non-shrink grout or ground down to match the unrepaired areas.
   6. Surfaces at cold joints shall be on the same plane.

3.02 PREPARATION

A. Follow Manufacturer's instructions for surface preparation.

3.03 INSTALLATION

A. Follow Manufacturer's instruction for installation.

3.04 PROTECTION

A. Reference Section 01500 – Construction Facilities and Temporary Controls.

B. Do not permit traffic over unprotected surfaces until system is completely cured per Manufacturer's recommendations.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Waterproofing Membrane will be measured for payment at the Contract unit price per square foot.

4.02 PAYMENT

A. The accepted quantity of Waterproofing Membrane including full compensation for furnishing, handling, transporting, and placing the material specified, including primer, aggregate, surface preparation, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
071800.11	Square Foot

END OF SECTION 071800

SECTION 071900

WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of a penetrating sealer/corrosion inhibitor applied to new and existing concrete surfaces as identified on contract drawings.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-in-place Concrete.

C. Section 071800 – Waterproofing Membrane.

D. Section 079200 – Joint Sealants.

E. General Requirements.

1.03 REFERENCES

A. ASTM International (ASTM)
   1. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
   2. ASTM E 96 – Standard Test Method for Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01300 – Submittals.

B. Product Data: Submit Manufacturer's product literature and installation instructions.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

1.06 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing products specified in this Section with minimum of five years documented experience.

B. Contractor:
   1. Minimum three years documented experience in Work of this Section and approved by Manufacturer. Contractor shall maintain qualified personnel who have received product training by manufacturer’s representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.
   1. Name of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Material safety data sheet.

B. Reference Section 01600 – Material and Equipment.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

   1. Do not apply coating if ambient or surface temperature is below freezing.
   2. Do not apply coating if possibility of entrapped or frozen water exists.
   3. Do not apply coating if rain is expected during next 72 hours.
   4. Do not apply during high winds.
   5. Prevent overspray onto adjacent materials.

B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

1.09 SEQUENCING

A. Allow joint sealants to cure minimum 48 hours after their application before applying coating.

B. Allow water repellent to cure minimum 5 days after application before applying joint sealers to coated surfaces.

PART 2 PRODUCTS

2.01 MATERIAL

A. Penetrating Sealer / Corrosion Inhibitor: The material shall be a one-component material consisting of a penetrating-type sealer which does not alter the color or texture of the Portland cement concrete. The material shall contain corrosion inhibitor qualities that consist of an impregnation coating for hardened concrete surfaces designed to penetrate the surface and then diffuse in vapor or liquid form to the steel reinforcing bars in the concrete to form a protective layer on the steel surface which inhibits corrosion.

2.03 MANUFACTURERS

A. Penetrating Sealer/Corrosion Inhibitor Acceptable Manufacturers:
   1. Sika FerroGard 908
   2. Evonik Protectosil 300
   3. Or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before any water repellent work is started the water repellent applicator shall thoroughly examine all surfaces for any deficiencies. Should any deficiencies exist, the Contractor shall notify the Design Engineer in writing and make required corrections.

B. Condition of Concrete Surfaces:
   1. The concrete surfaces shall be of sound structural grade and shall have a smooth finish, free of fins, ridges, voids or entrained air holes.
   2. Concrete shall be cured at least 7 days and shall be sloped for proper drainage.
   3. Voids, rock pockets and excessively rough surfaces shall be repaired with approved non-shrink grout or ground to match the unrepaired areas.
   4. Surfaces at cold joints shall be on the same plane.

3.02 PREPARATION

A. Follow Manufacturer's instructions for surface preparation.

3.03 APPLICATION

A. Follow Manufacturer's instructions for application.

B. Apply at rate recommended by Manufacturer.

3.04 CLEANING

A. Reference Section 01700 – Contract Closeout.

3.05 FIELD QUALITY CONTROL

A. After coating has dried, test surfaces with water spray; reapply to any areas showing water absorption.

3.06 PROTECTION

A. Reference Section 01500 – Construction facilities and Temporary Controls.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Penetrating Sealer / Corrosion Inhibitor will be measured for payment at the Contract unit price per gallon.

4.02 PAYMENT

A. The accepted quantity of Penetrating Sealer / Corrosion Inhibitor including full compensation for furnishing, transporting, hauling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per gallon.

Pay Item		Pay Unit
071900.01	(College St)	Gallon
071900.02	(Marketplace)	Gallon

END OF SECTION 071900

SECTION 07 5300

ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, ballasted conventional, ballasted protected membrane, mechanically fastened conventional, and adhered conventional application.

B. Flashings.

1.02 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension; 2006a (Reapproved 2013).

C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).

D. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2013.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.06 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide 20 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Carlisle Roofing Systems, Inc; Sure-Seal EPDM: www.carlisle-syntec.com.
   2. Firestone Building Products, LLC: www.firestonebpco.com.
   3. GenFlex Roofing Systems, LLC: www.genflex.com.
   4. Versico, a division of Carlisle Construction Materials Inc; VersiGard EPDM: www.versico.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over insulation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D4637.
   1. Thickness: 0.060 inch.

2. Sheet Width: 76 inch, minimum; factory-fabricate into largest sheets possible.
3. Color: Black.
4. Tensile Strength: 1300 psi, measured in accordance with ASTM D412.
5. Ultimate Elongation: 300 percent, measured in accordance with ASTM D412.
6. Tear Strength: 150 lbf/in, measured in accordance with ASTM D624.
7. Water Vapor Permeability: 0.10 perm inch, measured in accordance with ASTM E96/E96M.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane; conforming to the following:

2.04 INSULATION

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type I, aluminum foil both faces; Class 1, non-reinforced foam core and with the following characteristics:
   1. Compressive Strength: 16 psi
   2. Board Size: 48 x 96 inch.
   3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
   4. Board Edges: Square.
   5. Manufacturers:
      a. Dow Chemical Co: www.dow.com.
      b. GAF: www.gaf.com.
      c. Hunter Panels, LLC; H-Shield: www.hpanels.com.
      d. Versico, a division of Carlisle Construction Materials Inc; SecurShield Insulation: www.versico.com.
      e. Roofing manufacturer.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Roofing Expansion Joint Flashing: Sheet butyl.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Insulation Adhesive: As recommended by insulation manufacturer.

F. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane. (Walk pads minimum from roof access point to and around maintainable elements such as roof drains, skylights and vents).
   1. Composition: Asphaltic with mineral granule surface.
   2. Size: 18 x 18 inch.

3. Surface Color: White or yellow.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 CONCRETE DECK PREPARATION

A. Fill surface honeycomb and variations with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

E. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

F. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.

G. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage. Cricket all areas on roof surface that could prohibit positive slope to drain

C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by Manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.

H. Coordinate installation of roof drains and sumps and related flashings.

I. Store and replace existing ballast. Coordinate roof drain basket with mechanical such that basket prohibits passage of ballast into drain assembly.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of roof membrane repair will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of roof membrane including full compensation for performing the work specified, including membrane, insulation, flashing, sealants, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
07 5300.01 Reroofing as described above	Each

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING, ROOF SPECIALTIES AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

C. Manufactured roof specialties, including copings, fascias, and gravel stops.

D. Reglets and accessories.

E. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

H. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction; 2012.

I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

K. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2003 (Reapproved 2009).

L. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

M. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2013a.

N. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA 1793 and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Design Team from manufacturer's standard colors.

C. Aluminum: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick; anodized finish of color as selected.
   1. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils (0.018 mm) thick.

D. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick; plain finish shop pre-coated with modified silicone coating.
   1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
   2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   3. Color: As selected by Design Team from manufacturer's standard colors.

E. Lead: ASTM B749, 2.5 lb/sq ft (0.99 mm) thick.

F. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch (0.4 mm) thick; smooth No. 4 finish.

G. Terne Coated Steel: 0.015 inch (0.4 mm) thick copper bearing carbon steel core material with 0.092 lb/sq ft (0.45 kg/sq m) terne alloy coating on both sides of core metal.

H. Copper: ASTM B370, cold rolled 16 oz/sq ft (0.5 mm) thick; natural finish.

I. Lead Coated Copper: ASTM B101, 24 (7320) ounce-weight of bare copper, HOO (cold-rolled) temper.

J. Terne Coated Stainless Steel: 0.015 inch (0.4 mm) ASTM A666 Type 304 core material with 0.092 lb/sq ft (0.45 kg/sq m) terne alloy coating on both sides of core metal.

2.02 MANUFACTURERS

A. Roof Edge Flashings and Copings:

1. Architectural Products Co; www.archprod.com.
2. W.P. Hickman Company; PermaSnap 2 Coping: www.wph.com.
3. Metal-Era Inc; www.metalera.com.

B Pipe and Penetration Flashings:

1. Basis of Design: Portals Plus; www.portalsplus.com.

C. Reglets:

1. Basis of design: Fry Reglet http://fryreglet.com/reglets-flashings/

2.03 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Fascia, cant, and edge securement for roof membrane;
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable code.
3. Material: Extruded aluminum, 0.08 inch (2.0 mm) thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 RE-3 to positive and negative design wind pressure as defined by applicable code.
3. Material: Formed aluminum sheet, 0.050 inch (1.3 mm) thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.

C. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accomodating pipes sized between 0.375 inches (9.5 mm) and 12 inches (30.5 cm).

D. Engineered Roof Perimeter Blocking: Prefabricated 20 gage, 0.036 inch (0.91 mm) galvanized steel retainer for lightweight concrete; with cleat to accept copings; attach to roof deck in lieu of wood blocking at roof edge; for low slope roof installations.

1. Style: Box or Cant to match existing (or ask Architect).

E. Reglets: Type appropriate for substraight, and as suggested by the manufacturer.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

(No visually exposed fasteners unless specifically approved by Architect, prior to ordering)

B. Underlayment: ASTM D2178, glass fiber roofing felt.

C. Primer: Zinc chromate type.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

F. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

G. Sealant for Joints in Linear Components: As recommended by component manufacturer.

H. Plastic Cement: ASTM D4586, Type I.

I. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

J. Solder: ASTM B32; Sn50 (50/50) type.

K. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

2.05 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, minimum 3 inches wide, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

1. Where indicated use butt joints with backer plates.

F. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

G. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

I. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Through-Wall Flashing in Masonry:

B. Fascia and Cornices:

C. Coping, Cap, Parapet, Sill and Ledge Flashings:

D. Flashings Associated with Slopped Roofing, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney:

E. Sheet Metal Roof Expansion Joint Covers, and Roof-to-Wall Joint Covers:

F. Counterflashings at Roofing Terminations (over roofing base flashings):

G. Counterflashings at Curb-Mounted Roof Items, including skylights and roof hatches:

H. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports:

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of flashing and trim will be measured for payment at the Contract unit price per linear foot.

4.02 PAYMENT

A. The accepted quantity sheet metal flashing and trim including full compensation for performing the work specified, including sheet metal flashing and trim, fasteners, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Linear foot.

Pay Item	Pay Unit
07 6200.01 - Flashings and counter flashings	Linear foot
07 6200.02 - Coping Repair	Linear foot

(Sealants for joints within sheet metal fabrications incidental to 07 6200.01)

Manufactured roof specialties and roof accessories incidental to 07 5300.01

Masonry copings, fascia's see pay item: 04 2000.02

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes joint backing, precompressed foam sealers, isolation joints, and accessories.

B. Section includes precast concrete double-tee flange-to-flange joints and various precast to precast joints.

C. Section includes cast-in-place tooled or routed sealant infills

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 024119 – Selective Demolition.

C. Section 024120 – Hydrodemolition.

D. Section 030130 – Maintenance of Concrete.

E. Section 07100 – Waterproofing Membrane.

F. General Requirements.

1.03 REFERENCES

A. ASTM International (ASTM):
   1. C920 – Standard Specification for Elastomeric Joint Sealants.
   2. C1193 – Standard Guide for Use of Joint Sealants.
   3. D1056 – Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
   4. D1667 – Standard Specification for Flexible Cellular Materials – Poly (Vinyl Chloride) Foam (Closed-Cell).
   5. D2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01300 – Submittals.

B. Products Data: Submit Manufacturer's product literature and installation instructions.

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

1.06 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing products specified in this Section with minimum of five years documented experience.

B. Contractor:
   1. Minimum three years documented experience in Work of this Section and approved by Manufacturer. Contractor shall maintain qualified personnel who have received product training by manufacturer's representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.
   1. Name of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Material safety data sheet.

B. Reference Section 01600 - Material and Equipment.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Maintain temperature and humidity recommended by sealant Manufacturer during and after installation.
   2. Sealants shall only be installed on dry, clean surfaces.

PART 2 PRODUCTS

2.01 MATERIAL

A. General Purpose Traffic Bearing Sealant: 2-component, Polyurethane elastomeric sealant complying with ASTM C920, Class A, Type 1. Type 2 (non-sag) shall be used for all cove joints and may be acceptable in other locations with approval by the Design Engineer.

2.02 MANUFACTURERS AND PRODUCTS

A. Joint Sealant:
   1. Sika Corporation, Inc., Sikaflex-2c SL
   2. Or approved equal

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant Manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant Manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape or fine sand recommended by sealant Manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces and joint openings are ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove existing joint material, including backer rods or other related appurtenances as required. See Technical Specification Sections 024119 and 024120 for additional information.

B. Remove loose materials and foreign matter impairing adhesion of sealant.

C. Clean and prime joints.

D. Perform preparation in accordance with ASTM C1193.

E. Protect elements surrounding Work of this section from damage or disfiguration.

3.03 INSTALLATION

A. Perform installation in accordance with ASTM C1193.
   1. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
   2. Cut or grind existing edge of control joints to ensure a smooth edge.

B. Install bond breaker where joint backing is not used.

C. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

D. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Tool joints concave per detail in the Contract Drawings. Over-filled joints will be rejected and will be replaced by the Contractor at no additional cost to the Owner.

F. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 inch to ¼ inch below adjoining surface.

G. Cove Joints: Ensure that sealants are compatible with the existing surface treatment, bare concrete or concrete with waterproofing membrane applied.

3.04 CLEANING

A. Reference Section 01700 – Contract Closeout.

B. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Reference Section 01500 – Construction Facilities and Temporary Controls.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Joint Sealant will be measured for payment at the Contract unit price per linear foot.

B. The quantity of Joint Sealant Patch Replacement at existing bolt locations on Level 4 of the College Street Garage will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of Joint Sealant for Double Tee Beams including full compensation for removal of exiting joint sealer and appurtenances (where applicable), furnishing, handling, placing, and installing the materials specified, including any required backer rod or bond breaker; for preparing, including cleaning the joint prior to installing the sealer; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
079200.01	Linear Foot

B. The accepted quantity of Joint Sealant for C.I.P. Concrete Repairs including full compensation for removal of exiting joint sealer and appurtenances (where applicable), furnishing, handling, placing, and installing the materials specified, including any required backer rod or bond breaker; for preparing, including routing where required, and cleaning the joint prior to installing the sealer; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
079200.11	Linear Foot

C. The accepted quantity of Joint Sealant Patch Replacement including full compensation for removal of exiting joint sealer and appurtenances (where applicable), furnishing, handling, placing, and installing the materials specified; for preparing, minor concrete patching where required, and cleaning the joint prior to installing the sealer; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
079200.21	Each

END OF SECTION 079200

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel doors and frames.

B. Fire-rated steel doors and frames

C. Thermally insulated steel doors.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

E. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

F. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014. (ANSI/BHMA A156.115)

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

H. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
   a) Type, style, function, size, and finish of each hardware item.
   b) Name and manufacturer of each item.
   c) Fastenings and other pertinent information.
   d) Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e) Explanation of all abbreviations, symbols, and codes contained in schedule.
   f) Mounting locations for hardware.
   g) Door and frame sizes and materials.
   h) Keying information.
2. Hardware Submittal to be prepared by a professional door hardware specifier.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. De La Fontaine Inc: www.delafontaine.com.
   3. Steelcraft, an Allegion brand: www.allegion.com/us.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   1. Accessibility: Comply with ICC A117.1 and ADA Standards.
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   4. Door Texture: Smooth faces.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.

7. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness
8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 1 - Full Flush.
2. Core: Polyurethane.
3. Thickness: 1-3/4 inch.
4. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
5. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
6. Weatherstripping: Separate, see Section 08 7100.

B. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 2 - Heavy-Duty, Physical Performance Level B, Model 1 - Full Flush.
2. Core: Kraftpaper honeycomb.
3. Thickness: 1-3/4 inch.

C. Interior Doors, Fire-Rated:

1. Grade: ANSI/SDI A250.8 (SDI-100); Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 1 - Full Flush.

2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").

a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).

b. Attach fire rating label to each fire rated unit.

2.04 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

B. Exterior Door Frames: Face welded, seamless with joints filled.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Face welded type.

D. Interior Door Frames, Fire-Rated: Face welded type.

2.05 ACCESSORY MATERIALS

A. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 DOOR HARDWARE

A: Hardware types:

1. Hardware Set No. 1:

a.	1 ½ pair Hinges	Hager BB1199 - 4-1/2 x 4-1/2	US32D
b.	1 Panic Device	Sargent 8815 ETL	US32D
c.	1 Closer	Sargent EN 350-H	
d.	1 Armor Plate	Ives 8400 DW - 2" x 36BE3	US32D
e.	1 Threshold	National Guard 8426	
f.	1 Set WS	National Guard A626A	
g.	1 Overhead Stop	Sargent 1544S	US26D

2. Hardware Set No. 2:

a.	1-1/2 pair Hinges	Hager BB1279 - 4-1/2 x 4-1/2	US32D
b.	1 Lockset	Russwin CL3657 NZD	626
c.	1 Closer	Sargent EN 350-H	
d.	1 Wall Stop	Ives 449	B26D
e.	3 Silencers	Ives 20	
f.	1 Set WS	National Guard A626A	

3. Hardware Set No. 3: Each to have:

a.	2 Continuous Hinges	Hager 790-900	US32D
b.	1 Lockset	Russwin CL3657 NZD	626
c.	1 Pr.Auto. FB	Ives FB31P	US26D
d.	1 Dustproof Strike	Ives 488 US26D	
e.	2 Closers	Sargent EN 350-H	
f.	1 Threshold	National Guard 8426	
g.	1 Set WS	National Guard A626A	
h.	2 Overhead Stops	Sargent 1544S	US26D

4. Hardware Set No. 4: Storefront Doors: Each to have:
   a. 1 Cylinder
   b. Hardware supplied by Aluminum Entrances and Storefronts Manufacturer.

B. Coordinate keying with owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. If installing the frame in an existing block wall, it will need to be "punch and dimpled".

F. Coordinate installation of hardware.

3.04 TOLERANCES

A. Clearances Between Door and Frame: As indicated in ANSI/SDI A250.8 (SDI-100).

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of hollow metal doors, frames and door hardware will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of Metal Doors, Frames and Door Hardware including full compensation for performing the work specified, including door, paint, hardware, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
08 1113.01	Each

END OF SECTION

SECTION 08 4313

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of metal.

C. Aluminum doors and frames.

D. Weatherstripping.

E. Door hardware.

1.02 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.

B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Not Thermally-Broken:

1. Basis of Design: Kawneer North America; Trifab VersaGlaze 450.

B. NOTE: Storefront only for non-conditioned spaces areas as they are not thermally broken. For conditioned spaces thermally broken (isolated) systems are required

2.02 MANUFACTURERS

A. Aluminum-Framed Storefront and Doors:
   1. C.R. Laurence Co., Inc; U.S. Aluminum: www.crl-arch.com.
   2. EFCO Corporation: www.efcocorp.com.
   3. Kawneer North America: www.kawneer.com.
   4. YKK AP America Inc: www.ykkap.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.03 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of applicable code.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Snow Loads for Sloped or Horizontal Elements: Comply with requirements of applicable code.
   3. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8.00 lbf/sq ft.

4. Air Leakage: Maximum of 0.06 cu ft/min/sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot pressure differential across assembly.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Glazing stops: Flush.
   2. Cross-Section: 2 x 4 1/2 inch nominal dimension.

B. Glazing: Sealed Insulating Glass Units: Vision glass, double glazed
   1. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
   2. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   3. Total Thickness: 1 inch.
   4. Edge Spacers: Aluminum or stainless steel, bent and soldered corners.
   5. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   6. Purge interpane space with dry hermetic air.

C. Infill Panels: Composite panels, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Thickness: ¼ inch.
   2. Finish: Same as storefront.

D. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches.
   2. Top Rail: 4 inches wide.
   3. Vertical Stiles: 4-1/2 inches wide.
   4. Bottom Rail: 10 inches wide.
   5. Glazing Stops: Square.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.07 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
   1. Finish on Hand-Contacted Items: Polished chrome.
   2. For each door, include pivots, push handle, pull handle, and closer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Install glass and infill panels in accordance with Section 08 8000, using exterior dry glazing method.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage during subsequent construction.

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of aluminum storefront framing will be measured for payment at the Contract unit price per Lump Sum.

B. The quantity of storefront glazing (infill) will be measured for payment at the Contract unit price per Lump Sum.

C. The quantity of storefront doors will be measured for payment at the Contract unit price per each leaf.

4.02 PAYMENT

A. The accepted quantity of aluminum storefront framing including full compensation for performing the work specified, including aluminum framing, sealants, hardware, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum.

Pay Item	Pay Unit
08 4313.01	Lump Sum

B. The accepted quantity of storefront glazing including full compensation for performing the work specified, including glazing, sealants, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum.

Pay Item	Pay Unit
08 4313.02	Lump Sum

C. The accepted quantity of storefront doors including full compensation for performing the work specified, including door, hardware, threshold, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each leaf.

Pay Item	Pay Unit
08 4313.03	Each Leaf

END OF SECTION

SECTION 08 4413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Renovate existing Curtainwall, including replacing identified glazing, replace glazing with insulated Metal panel where indicated, regasketing, all new snap caps to match existing.

1) All colors, finishes and appearance to match existing.

B. Provide alternate for all new multi-story curtain wall system to replace existing. Include new insulated metal spandrel panels. Aluminum-framed curtain wall, with vision glazing and glass, and metal, infill panels.

C. Associated louvers.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

J. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2010.

K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

C. Verifying existing condition dimensions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

G. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

H. Field Quality Control Submittals: Report of field testing for water leakage.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Curtain Wall:
   1. EFCO, a Pella Company: www.efcocorp.com.
   2. Kawneer North America: www.kawneer.com.
   3. Oldcastle Building Envelope: www.oldcastlebe.com.
   4. YKK AP America Inc: www.ykkap.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Fabrication Method: Either shop/factory or field fabricated system.
   3. Glazing Method: Either shop/factory or field glazed system.
   4. Vertical Mullion Face Width: 2-1/2 inches (63.5 mm).
   5. Vertical Mullion Depth From Face of Glazing to Back of Frame: 6-1/4 inches (159 mm).
   6. Finish: Painted Factory Finish - AAMA 2605.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   7. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
   11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the Project Requirements
      c. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.

2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
   a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
   b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
   c. Movement of curtain wall relative to perimeter framing.
   d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 lbf/sq ft (480 Pa).

D. Air Leakage: Maximum of 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot (300 Pa) pressure differential across assembly.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Glazing: As specified in Section 08 8000.

C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Face Sheet: 0.062 inch thick.
   2. Core: Glass fiber insulation core
   3. Back Sheet: 0.062 inch thick.
   4. Exterior Finish: High performance organic coatings.
   5. Interior Finish: Clear anodized.

D. Louvers: Extruded aluminum blades and frame, 4 inches (100 mm) deep; fabricated to eliminate blade flutter.
   1. Blades: 45 degree slope.
   2. Finish: Same as curtain wall mullion sections.

E. Louver Screening:
   1. Bird screen at exhaust louvers inside surface.
   Interwoven wire mesh of steel 0.063" diameter wire, with 1/2" open weave, square design

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

E. Concealed Flashings: Stainless steel, 26 gage, 0.0187 inch (0.48 mm) minimum thickness.

F. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

G. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: As specified in Section 08 8000.

J. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Color: To be selected by Design Team from manufacturer's standard range.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Install louvers and associated flashings.

H. Install all new pressure plate cover caps and associated sealant on entire Curtain wall(s) being affected. (Color to match existing).

I. Sloped Glazing with External Horizontal Mullions: Place sealant on the upslope side of the pressure plate cover caps; finish the surface with a slope for drainage over the cap.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Test installed curtain wall for water leakage in accordance with AAMA 501.2.

B. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Curtain wall and associated work will be measured for payment at the contract unit price per each.

4.02 PAYMENT

A. The accepted quantity Curtain wall including full compensation for performing the work specified, including Curtain Wall, Engineering, Glazing and Accessories, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
08 4413.01 Curtain Wall Repair - Lower Glass X2 - Mpg	Lump sum

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers.

B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

C. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished by storefront manufacturer.

D. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing furnished by wall manufacturer.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

I. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

J. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Certificates: Certify that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glass, double glazed.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
      a. Tint: Bronze.
      b. Coating: Low-E (passive type), on #2 surface.
   3. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
      a. Tint: Clear.
   4. Total Thickness: 1 inch (25 mm).
   5. Total Visible Light Transmittance: not less than 1.1 times SHGC.
   6. Total Solar Heat Gain Coefficient: .40 percent, nominal.

2.02 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glazing, with Low-E coating.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Between-lite space filled with air.
   3. Basis of Design: PPG Industries, Inc: www.ppgideascapes.com.
   4. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
      a. Low-E Coating: PPG Solarban 60 on #2 surface.
   5. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick.
      a. Tint: Clear.
   6. Total Thickness: 1 inch (25 mm).
   7. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
   8. Substitution Procedures: See Section 01 6000 - Product Requirements.
      a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 GLAZING UNITS

A. Type IG-3 - Sealed Insulating Glass Units: Safety glazing.
   1. Application: Provide this type of glazing in the following locations:
      a. Glazed lites in exterior doors.
      b. Glazed sidelights and panels next to doors.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on the drawings.

2. Type: Same as other vision glazing except use fully tempered float glass for both outboard and inboard lites.
3. Tint: Clear.

B. Type S-3 - Single Safety Glazing: Non-fire-rated.
1. Application: Provide this type of glazing in the following locations:
a. Glazed lites in doors, except fire doors.
b. Glazed sidelights to doors, except in fire-rated walls and partitions.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on the drawings.
2. Type: Fully tempered float glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm).

C. Type S-OG - Obscure Glazing: Translucent, showing shadows but not forms.
1. Application: Locations indicated on the drawings.
2. Type: Patterned glass, fully tempered.
3. Tint: Clear.
4. Thickness: 1/4 inch (6 mm), nominal.

2.04 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
3. Glass thicknesses listed are minimum.

B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.05 GLASS MATERIALS

A. Float Glass Manufacturers:
1. AGC Glass Company North America, Inc: www.us.agc.com.
2. Cardinal Glass Industries: www.cardinalcorp.com.
3. Guardian Industries Corp: www.sunguardglass.com.
4. Pilkington North America Inc: www.pilkington.com/na.
5. PPG Industries, Inc: www.ppgideascapes.com.

B. Float Glass: Provide float glass glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
3. Tinted Types: Color and performance characteristics as indicated.
4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Comply with 16 CFR 1201 test requirements for Category II.
2. Plastic Interlayer: 0.060 inch (1.52 mm) thick, minimum.
3. Where fully tempered is specified or required, provide glass that has been tempered by the tong-less horizontal method.
4. Manufacturers:
   a. Cardinal Glass Industries: www.cardinalcorp.com.
   b. Viracon, Apogee Enterprises, Inc: www.viracon.com.
   c. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Patterned Glass: Cast or molded glass.
1. Manufacturers:
   a. Oldcastle Glass: www.oldcastleglass.com.
   b. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.06 SEALED INSULATING GLASS UNITS

A. Manufacturers:
1. Any of the manufacturers specified for float glass.
2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
3. Cardinal Glass Industries: www.cardinalcorp.com.
4. Viracon, Apogee Enterprises, Inc: www.viracon.com.

B. Sealed Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Edge Spacers: Aluminum, bent and soldered corners.
3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

2.07 GLAZING COMPOUNDS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
3. Pecora Corporation: www.pecora.com.
4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Glazing Putty,: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

C. Butyl Sealant,: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

D. Polysulfide Sealant,: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

E. Silicone Sealant,: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25.

2.08 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.05 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.

1. Place glazing tape on glazing pane of unit with tape flush with sight line.

F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - EXTERIOR WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.

C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.07 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.08 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.09 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of glazing will be measured for payment at the Contract unit price per square foot.

4.02 PAYMENT

B. The accepted quantity of glazing including full compensation for performing the work specified, including glazing, sealants, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot.

Pay Item	Pay Unit
08 8000.01	Square Foot

Glazing not identified as a Pay Item elsewhere.

END OF SECTION

SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 REFERENCE STANDARDS

A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, www.paintinfo.com.

D. SSPC-Paint 16 - Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint; Society for Protective Coatings; 1982 (Ed. 2006).

E. SSPC-SP 1 - Solvent Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

F. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

G. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

H. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; Society for Protective Coatings; 2012.

I. SSPC-SP 13 - Surface Preparation of Concrete; Society for Protective Coatings; 2003 (Reaffirmed 2015).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 10 years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only materials (primers, coatings, etc.) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.

B. Provide high performance coating products from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Design Team is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   3. Substitution of a different high performance coating system using MPI-approved products by the same manufacturer will be considered.

C. High-Performance Coatings:
   1. Carboline Company: www.carboline.com.
   2. Concrete Solutions by Rhino Linings; FastFloor: www.concretesolutions.com.
   3. PPG Architectural Finishes, Inc: www.ppgaf.com.
   4. Pratt & Lambert Paints: www.prattandlambert.com.
   5. Sika Corporation; Sikagard Hygiene Urethane Wall System: www.sikafloorusa.com.
   6. Sherwin-Williams Company;: www.protective.sherwin-williams.com/industries.
   7. Tnemec Company, Inc: www.tnemec.com.
   8. Substitutions: Section 01 6000 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."

B. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Abrasion Resistance: 145 mg loss, when tested in accordance with ASTM D4060, CS10 wheel, 1000 cycles, 1kg Load.
2. Water Resistance:

2.03 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Maximum Volatile Organic Compound (VOC) Content: As required by applicable regulations.
   2. Colors: Selected from manufacturer's standard colors.

B. Elastomeric Coating:
   1. Number of Coats: Two.
   2. Product characteristics:
   3. Top Coat(s): Exterior Pigmented Elastomeric, Water Based; MPI #113.
      a. Sheen: Flat.
   4. Primer: As recommended by coating manufacturer for specific substrate.

C. Epoxy Coating:
   1. Number of coats: Two.
   2. Product characteristics:
      a. Comply with the performance requirements specified above for moderate exposure.
   3. Top Coat(s): Polyamide Epoxy; MPI #77.
      a. Sheen: Gloss.
      b. Products:
         1) Pratt & Lambert Industrial Palgard Polyamide Epoxy.
         2) Sherwin-Williams Macropoxy 646 Fast Cure Epoxy. (MPI #177)
         3) Sherwin-Williams Macropoxy HS.
         4) Sherwin-Williams Tile Clad HS. (MPI #77)
   4. Top Coat(s): High Performance Institutional, Two-Component, Water Based Coating; MPI #254.
      a. Sheen: Eggshell.
      b. Products:
         1) Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy. (MPI #254)
         2) Substitutions: Section 01 6000 - Product Requirements.

D. High-Build Epoxy Coating:
   1. Number of Coats: Two.
   2. Product characteristics:
      a. Comply with the performance requirements specified above for moderate exposure.
   3. Top Coat(s): Epoxy, High-Build; MPI #98.
      a. Sheen: Gloss.
      b. Products:
         1) Pratt & Lambert Industrial High Build Mastic Epoxy.
         2) Sherwin-Williams Macropoxy 646 Fast Cure Epoxy. (MPI #108, 120)
         3) Sherwin-Williams Pro Industrial High Performance Epoxy. (MPI #98)

E. Urethane Coating
   1. Number of Coats: Two.

2. Product characteristics:
   c. Comply with the performance requirements specified above for moderate exposure.
3. Top Coat(s): Polyurethane, Two-Component; MPI #72.
   a. Sheen: Semi-Gloss.
   b. Products:
      1) Sherwin-Williams Acrolon 218 HS. (MPI #72, 174)
      2) Substitutions: Section 01 6000 - Product Requirements.
4. Top Coat(s): Polyurethane Varnish, Moisture Cured; MPI #31.
   a. Sheen: Gloss.
   b. Products:
      1) Sherwin-Williams ArmorSeal Rexthane Moisture Cured Urethane. (MPI #31)
      2) Substitutions: Section 01 6000 - Product Requirements.
5. Top Coat(s): Acrylic Urethane, Water Based, Two-Component.
   a. Sheen: High Gloss.
   b. Products:
      1) Pratt & Lambert Industrial Acrylic Urethane.
      2) Sherwin-Williams Pro Industrial Waterbased Acrolon 100.
      3) Substitutions: Section 01 6000 - Product Requirements.
6. Primer: As recommended by coating manufacturer for specific substrate.

F. Epoxy Floor Coating
   1. Number of Coats: One.
   2. Product characteristics:
   3. Top Coat(s): Polyamide Epoxy, Two-Component.
      a. Sheen: Gloss.
      b. Products:
         1) Sherwin-Williams ArmorSeal 1000 HS.
         2) Substitutions: Section 01 6000 - Product Requirements.
   4. Primer: As recommended by coating manufacturer for specific substrate.

G. Coal Tar Epoxy Coating:
   1. Number of Coats: One.
   2. Product characteristics:
      a. Comply with the performance requirements specified above for moderate corrosive exposure.
   3. Top Coat(s): Coal Tar Polyamide Epoxy, Two-Component, SSPC-Paint 16.
      a. Sheen: Flat.
      b. Products:
         1) Substitutions: Section 01 6000 - Product Requirements.
   4. Primer: As recommended by coating manufacturer for specific substrate.

H. Shellac: Pure, white type.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
   1. Primer Sealer, Interior, Institutional Low Odor; MPI #149.
   2. Block Filler, Epoxy; MPI #116.
   3. Block Filler, Latex; MPI #4.
      a. Products:

1) Sherwin-Williams Heavy Duty Block Filler. (MPI #4)
2) Sherwin-Williams PrepRite Interior/Exterior Block Filler. (MPI #4)
3) Substitutions: Section 01 6000 - Product Requirements.

4. Surface Tolerant, Anti-Corrosive for Metal, Alkyd; MPI #23.
   a. Products:
      1) Sherwin-Williams Kem Bond HS. (MPI #23)
      2) Substitutions: Section 01 6000 - Product Requirements.
5. Anti-Corrosive for Metal, Alkyd; MPI #79.
   a. Products:
      1) Sherwin-Williams Kem Bond HS. (MPI #79)
      2) Substitutions: Section 01 6000 - Product Requirements.
6. Anti-Corrosive for Metal, Epoxy; MPI #101.
   a. Products:
      1) Substitutions: Section 01 6000 - Product Requirements.
7. Zinc Rich, Inorganic; MPI #19.
   a. Products:
      1) Sherwin-Williams Zinc Clad III HS 100.
      2) Substitutions: Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Design Team of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Concrete Floors and Traffic Surfaces: 8 percent.

H. Masonry: Verify masonry joints are struck flush.

I. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:
   1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by coating manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi (4140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:
   1. Solvent clean according to SSPC-SP1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.
   4. In addition, for surfaces to be finished with Coating Type ___, remove tight rust, and shop primer, if any to bare metal using power tools according to SSPC-SP 11 "Power Tool Cleaning to Bare Metal", and protect from corrosion until coated.

J. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

C. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils (0.8 mm).

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, and specified thickness, Contractor shall pay for retesting and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations, and specified thickness.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

A. Protect finished work from damage.

3.08 SCHEDULE

A. Walls in Equipment Rooms: High-build epoxy, gloss.

B. Concrete Floors in Elevator shaft and Elevator Machine Rooms: Opaque epoxy floor coating, non-skid finish.

C. Exterior Ferrous Metal Railings and Handrails, Fences, Gates: Epoxy, gloss, shop-applied after cleaning to bare metal, all surfaces coated including surfaces to be concealed or embedded in concrete.

D. Steel Lintels to be Embedded in Concrete and Masonry: Coal tar epoxy coating, shop-applied, all surfaces.

E. **EXTERIOR PAINTING** (Basis of Design):

1. Concrete and masonry: Flat Acrylic Finish

   1 coat Primer:Tnemec, Series 181 Tneme-Crete, 8-10 mils DFT, or approved equal.

   1 coat Tnemec , Series 181 Tneme-Crete, 8-10 mils DFT, or approved equal

2. Ferrous-Metal - Semigloss Acrylic Finish

   1 coat Primer:Tnemec, Series 90-97 Tneme-Zinc, 3.0 mils DFT, or approved equal

   2 coats Tnemec, Series 73 Endura-Shield, 3.0 mils DFT, or approved equal.

F. **INTERIOR PAINTING** (Basis of Design):

1. Concrete Masonry Units: Water Base Acrylic Epoxy Coating

   1 coat: Block Filler

   2 coats: Water Base Acrylic Epoxy

2. Metal Surface-Tnemec Finish

   All metal stair and rail parts

   3 coats: Factory applied finish
   Power wash

   1 coat: Tnemec Series 73/74 Endura-Shield (Level 3)

3. Ferrous Metal

   1 coat: Metal Primer

   2 coats: Alkyd Flat, Alkyd Eggshell Enamel or Alkyd Semi-Gloss Enamel as selected by Architect.

   Omit Primer Coat when shop primed; spot prime all marred or ruptured

   Shop Primer Coats with Primer specified.

4. Galvanized Metal

   1 coat: Galvanized Metal Primer

   2 coats: Alkyd Flat, Alkyd Eggshell Enamel or Alkyd Semi-Gloss Enamel as selected by Architect

G. **Colors:**

As indicated on drawings or as selected by Architect from standard range.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of high-performance coatings will be measured for payment at the Contract unit price per Pay Unit as listed below.

4.02 PAYMENT

A. The accepted quantity of high-performance coatings including full compensation for performing the work specified, including high-performance coatings, and other accessory materials, and for furnishing all materials, including labor, tools, equipment,

and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
09 9600.01 – Painting lobby & stair walls, railings - CSG	Square foot
09 9600.02 – Exterior Concrete and Masonry	Square foot
09 9600.03 – Exterior Ferrous-Metal	Lump Sum
09 9600.04 – Interior Concrete Masonry Units	Square foot
09 9600.05 – Interior Metal Surface-Tnemec Finish	Lump Sum
09 9600.06 – Interior Ferrous-Metal	Lump Sum
09 9600.07 – Interior Galvanized Metal	Lump Sum
09 9600.08 – Epoxy floor coating	Square foot

END OF SECTION

SECTION 09 9723
CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High build, moisture resistant textured concrete and masonry coatings.

1.02 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011.

B. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2013.

C. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings; 1995 (Reapproved 2008).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

G. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

H. SSPC-SP 3 - Power Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

I. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

J. SSPC-SP 7 - Brush-Off Blast Cleaning; Society for Protective Coatings; 2007.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 10 years documented experience.

1.05 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Concrete and Masonry Coatings:
   1. Textured Coatings of America, Inc.: www.texcote.com.
   2. Substitutions: Section 01 6000 - Product Requirements.

2.02 CONCRETE AND MASONRY COATINGS

A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
   1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
   2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
   3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.03 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.
   1. Maximum volatile organic compound (VOC) content: As required by applicable regulations.

B. High Build, Water Based Textured Coating System for Masonry: Water based styrene-acrylic resin primer; acrylic terpolymer (elastomeric) top coat and graded perlite aggregate.
   1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
   2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
   3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
   4. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
   5. Water Vapor Transmission: 4.2 perms (240 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.
   6. Color: As indicated.
   7. Texture: To be selected by Design Team from manufacturer's standard range.
   8. Products:
      a. Textured Coatings of America, Inc; Tex-Cote 600 Textured Coating with Latex Block Filler: www.texcote.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

D. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:
   1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

F. Ferrous Metal:
   1. Solvent clean.
   2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3, or blast cleaning according to SSPC-SP 6 or -SP 7.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of concrete and masonry coatings will be measured for payment at the Contract unit price per Lump Sum.

4.02 PAYMENT

A. The accepted quantity of concrete and masonry coatings including full compensation for performing the work specified, including concrete and masonry coatings, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum.

Pay Item	Pay Unit
09 9723.01	Lump Sum

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc: www.bestsigns.com.
   2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com.
   3. Inpro; Aspen: www.inprocorp.com.
   4. Mohawk Sign Systems, Inc: www.mohawksign.com.
   5. Seton Identification Products: www.seton.com/aec.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 2 inches, unless otherwise indicated.
   5. Service Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
   6. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:
   1. Sign Type: Same as room and door signs.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.
   4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: To be selected by Architect.
   4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.

2.05 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain Owner's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

PART 1V MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of signs will be measured for payment at the Contract unit price per as listed below.

4.02 PAYMENT

A. The accepted quantity signs including full compensation for performing the work specified, including sign, adhesive, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price as listed.

Pay Item	Pay Unit
10 1400.01 Door Signage	Each
10 1400.02 Paint Wayfinding # Striping Stair Tower-CSG	Lump Sum
10 1400.03 Paint Wayfinding # Striping Beams/ Cols-CSG	Lump Sum

END OF SECTION

SECTION 14 0500

COMMON WORK RESULTS FOR ELEVATOR TOWER AND MACHINE ROOM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Consolidation of requirements for Market Place Garage Phase I elevator tower / machine room maintenance and repairs including incidental work associated with both.

1.02 RELATED REQUIREMENTS

A. Section 02 4229 Selective Demolition

B. Section 03 0130 Maintenance of Concrete

C. Section 04 2000 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

D. Section 05 5305 Metal Gratings and Floor Plates

E. Section 07 6200 Sheet Metal Flashing, Roof Specialties and Trim

F. Section 07 9200 Joint Sealants

G. Section 08 4413 Glazed Aluminum Curtain Walls

H. Section 08 8000 Glazing

I. Section 09 9600 High-Performance Coatings

J. Section 09 9723 Concrete And Masonry Coatings

K. Section 10 1400 Signage

L. Section 14 2400 Hydraulic Elevators

M. Section 22 3000 Plumbing Equipment

N. Section 23 0713 Duct Insulation

O. Section 23 0719 HVAC Piping Insulation

P. Section 23 3100 HVAC Ducts and Casings

Q. Section 23 3300 Air Duct Accessories

R. Section 23 3423 HVAC Power Ventilators

S. Section 23 3700 Air Outlets and Inlets

T. Section 23 4100 Air Filters

U. Section 25 0000 HVAC Instrumentation and Controls

V. Section 26 0526 Grounding and Bonding

W. Section 26 0533 Raceways and Boxes

X. Section 26 1519 Conductors and Cables

Y. Section 26 2726 Wiring Devices

Z. Section 26 5210 Lighting

AA. Section 32 1123 Aggregate Base Course

AB. Section 32 1313 Concrete Pavement

AC. Section 32 3119 Decorative Metal Fences and Gates

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. AISC 360 - Specification for Structural Steel Buildings; American Institute of Steel Construction, Inc.; 2010.

D. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.

E. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2012.

F. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2013.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

H. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2004 (Reapproved 2010).

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.

L. ASTM B135 - Standard Specification for Seamless Brass Tube; 2011.

M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

O. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010 w/Errata.

Q. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

R. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

S. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; National Fire Protection Association; 2013.

U. PS 1 - Structural Plywood; 2009.

V. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate all work and all trades related to work in the elevator tower.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. See specific section for the submittal requirements for each Section.

PART 2 PRODUCTS

A. Products, Component and Materials as specified in each individual Sections

PART 3 EXECUTION

Not Used

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. This section capturing all Market Place Garage Phase I elevator tower / machine room maintenance and repairs will be measured for payment at the Contract unit price on a lump sum basis.

4.02 PAYMENT

A. The accepted quantity of the Market Place Garage Phase I elevator tower / machine room maintenance and repairs will be paid for at the Contract lump sum price. Payment will be full compensation for performing the work specified and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per lump sum. Partial payments will be made as follows: 50% partial payment with the first payment request for this garage, 40% partial payment following the completion of 20% of the contract, excluding mobilization/demobilization, 10% will be made after the final acceptance date with the final payment request.

Pay Item	Pay Unit
14 0500.01	Lump Sum

Incidental architectural items for the Phase I elevator tower / machine room maintenance and repairs identified on AM1.0 through AM 5.1 not identified as Pay Items elsewhere in the specifications.

END OF SECTION

SECTION 14 2400
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydraulic elevator overhaul and selective replacement.
   1. Passenger type.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

C. Section 21 1300 - Fire Suppression Sprinklers: Sprinkler heads in hoistway.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. AISC 360 - Specification for Structural Steel Buildings; American Institute of Steel Construction, Inc.; 2010.

D. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.

E. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2012.

F. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2013.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

H. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2004 (Reapproved 2010).

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.

L. ASTM B135 - Standard Specification for Seamless Brass Tube; 2011.

M. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

N. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

O. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010 w/Errata.

Q. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

R. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

S. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; National Fire Protection Association; 2013.

U. PS 1 - Structural Plywood; 2009.

V. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. To elevator equipment devices remote from elevator machine room or hoistway.
      b. To machine room for telephone service.
      c. To elevator pit for lighting, and sump pump.
      d. To automatic transfer switch from controller cabinet.
      e. To fire alarm panel from controller cabinet.
   2. Coordinate the work with other installers for equipment provisions necessary for proper elevator operation including but not limited to:

B. Preinstallation Meeting: Convene a meeting one week prior to starting work.
   1. Review schedule of installation, installation procedures and conditions, and coordination with related work.

C. Maintain operation of at least one car throughout entire upgrade installation.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on the following items.
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Indicate the following information.
   1. Locations of Elevator Machine Equipment: Driving machines, power units, controllers, and other component.
   2. Hoistway Components: Car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Individual weight of principal components; load reaction at points of support.
   5. Clearances and over-travel of car.
   6. Locations in hoistway and machine room of traveling cables and connections for car lighting, and telephone.
   7. Location and sizes of doors and frames.
   8. Calculated heat dissipation of elevator equipment in machine room.
   9. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
   10. Interface with building security system.

11. Electrical characteristics and connection requirements.
12. Show arrangement of elevator equipment in machine room, and allow for clear passage of equipment through access door.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Contract: It is intended that the current contractor would resume in place PM agreement once work is completed.

1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

G. Operation and Maintenance Data:
1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
2. Operation and maintenance manual.
3. Schematic drawings and wiring diagrams.

1.06 QUALITY ASSURANCE

A. Maintain one copy of each quality standard document on site.

B. Designer Qualifications: Perform design under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

D. Installer Qualifications: Trained personnel and supervisor on staff of elevator equipment manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

F. Products Requiring Fire Resistance Rating: Listed and classified by testing agency acceptable to the authorities having jurisdiction.

G. Products Requiring Electrical Connection: Listed and classified by testing agency acceptable to the authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 12 month manufacturer warranty for elevator operating equipment and devices from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hydraulic Elevators - Basis of Design: Repair 2 Existing Schindler Elevators.

B. Hydraulic Elevators:
1. Schindler Elevator Corporation; Schindler 330A Low-Rise Holeless Hydraulic, Single Jack: www.us.schindler.com.

C. Substitutions: See Section 01 6000 - Product Requirements.
1. For any product not identified as Basis of Design, submit information as specified for substitutions.

2.02 HYDRAULIC ELEVATORS

A. Replace components of the existing elevator system (remove the entire cab and platform, and replace it with new custom draper elevator cabs with rigidized metal #4 stainless walls, and a screen print design on the exterior wall facing the street - ie no windows. We would also furnish and install new vandal resistant car operating panels and new LED digital position indicators and CE electronics drive units) to modernize and address the current challenges. Refurbish remaining existing systems including jacks and controls. Implement appropriate maintenance system.

B. Custom sized car to maximize size of car within existing shaft – may mean having one chamfered corner per car.

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code; ASME A17.1.
   3. Buffers: Re-Use
   4. Provide jack fluid collector reservoirs at the base of each existing jack
      a. Provide option to have collected fluid integrally reused by the system

B. Electrical Equipment:
   1. Motors: NEMA MG 1. Re-Use
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
   3. Sump Pump in Pit: Refer to Section 22 3000. New by others

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, authorities having jurisdiction (AHJ), and Burlington Public Works Requirements.

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
   1. Comply with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1 and other related requirements.
   2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.

E. Perform welding of steel in accordance with AWS D1.1/D1.1M.

F. Perform electrical work in accordance with NFPA 70.

G. Shut Trips are not allowable per VT Fire and Building Safety Code.

H. Furnish, Engineer and Install OSHA compliant fall arrest system (rails or tie offs) at the top of the elevator cars.

2.05 MATERIALS

A. Cylinder Casing: ASTM A139/139M, Grade A steel.

B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS, with matte finish.

D. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

F. Seamless Brass Tube: ASTM B135, Copper Alloy UNS No. C22000, 90 percent copper, polished finish.

G. Extruded Aluminum: ASTM B221 and ASTM B221M, natural anodized finish unless otherwise indicated.

H. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

I. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.

J. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of enamel sprayed and baked.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

L. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction.

M. Finish Paint for Wood Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction.

2.06 OPERATION CONTROLS

A. Vandal resistant buttons, interfaces, and indicators

B. Provide durable hinged button covers on emergency buttons as applicable.

As approved by Owner and Architect. (Similar in intent to image below):

2.08 EMERGENCY POWER

A. If current elevator has this capacity: Set-up elevator operation to run with elevator emergency power supply when the normal building power supply fails. (Re-Use existing no new provisions required).

2.09 HOISTWAY ENTRANCES – New #4 Stainless Steel Doors. New Complete Entrances with Silver Nickel Sills.

A. Hoistway Entrances; Main Floor Elevator Lobby:
   1. Framed Opening Material and Finish: Brushed stainless steel.

2. Door Material and Finish: Brushed stainless steel.
3. Hoistway Fire Rating: 2 Hours.
4. Door Fire Rating: 1-1/2 Hours.
5. Sills: nickel silver.

B. Hoistway Entrances; Upper Floor Elevator Landings:
1. Framed Opening Material and Finish: Brushed stainless steel.
2. Door Material and Finish: Brushed stainless steel.
3. Hoistway Fire Rating: 2 Hours.
4. Door Fire Rating: 1-1/2 Hours.
5. Sills: nickel silver.

C. Car Doors:
1. Car Door Material and Finish: To match the hoistway entrance doors.
2. Car Doors: 16 gage, 0.0598 inch (1.52 mm) minimum sheet thickness, rigid sandwich panel construction.
3. Sills: nickel silver.

2.10 MACHINE ROOM FITTINGS

A. Wall-Mounted Frames: Glazed with clear plastic; sized as required. Provide one chart each for master electric and hydraulic schematic and for lubrication chart. Install charts.

2.11 CAR FINISH MATERIALS

A. All finish materials and controls to be vandal resistant.

B. Steel Shell: Stainless Steel

C. Glass for Car Enclosures: Fully tempered, 1/2 inch (12.7 mm) minimum thickness, and in compliance with ASME A17.1, 16 CFR 1201 and ASTM C1048 safety glass requirements.

1. See Drawings for location(s) of glass in elevator cars and elevator hoistway(s).

D. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served, alarm button, and "Door Open" button. (All existing fixtures to be duplicated, strengthened where possible).
1. Position alarm button where it is unlikely to be accidentally actuated; not more than 54 inch (1372 mm) above car finished floor.
2. Provide matching service cabinet integral with front return panel, with hinged door and lock in each car.
3. Provide the following in each service cabinet as part of the operating panel:
a. Switch for each auxiliary operational control, keyed.
b. Switches for inspection, fan, and light,.
c. Emergency light.
d. Control for each other special feature specified.
e. Convenience outlet receptacle; 110 V, 15 A.
4. Provide keyed switches for each operational control specified, inspection control, fan, and light.
5. Locate convenience outlet receptacle below service cabinet.

E. Position Indicator: Above car operating panel with illuminating position indicators.

F. Comply with ADA Standards for operating panel and interior layout of car.

G. Stainless Steel Bumper Rail: Flat bar stock, 3/8 inch deep by 4 inch high, No. 4 Brushed finish.

H. Rails: Provide 1-1/2 inch (38 mm) clearance space from wall.

I. Ceiling System: As selected by Architect from manufacturers standard line.
   1. Steel canopy system.
   2. Frame Finish: Powder coated, color As selected from Standards.
   3. Panel Finish: No. 4 Brushed stainless steel.
   4. Lighting: LED downlights.

J. Resilient Flooring: Provide sheet flooring

   1) As an alternate provide Stainless Steel diamond plate flooring

K. Pad Hooks: Stainless steel type, mounted at typical high.

L. Protective Pads: Canvas cover, padded with sponge fill material, sewn with piping edges; brass grommets spaced to match pad hook spacing in car, covering side and rear walls and front return, except cut-out for control panel; provide one set.

M. Certificate Frame and Glazing: Stainless steel frame, clear tempered glass glazing, attached with tamper proof screws.

N. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

O. Ventilation: Two speed fan; grille in ceiling.

P. Prepare for vandal resistant in-car security cameras.

2.12 SECURITY DEVICES / CAMERAS

A. Include furnish and install Security Cameras including in cab wireless cameras in vandal resistant housing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components. Comply with requirements of Section 01 5000.

B. Maintain elevator pit excavation free of water.

C. Maintain in-ground elevator shaft excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories, (as needed for fixtures).

D. Install hydraulic piping between cylinder and pump unit.

E. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway. Rough Openings, per factory specifications, by others.

L. Fill hoistway door frames solid with grout in accordance with Section 04 2000.

M. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

N. Adjust equipment for smooth and quiet operation.

3.04 ERECTION TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion, (as required by code for scope of work).
   1. Schedule tests with agencies and notify Owner and Design Team.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
   4. Perform tests required by regulatory agencies.
   5. Furnish test and approval certificates issued by authorities having jurisdiction.

C. Perform testing and inspection in accordance with requirements.
   1. Inspectors shall be certified in accordance with ASME QEI-1.
   2. Perform tests as required by ASME A17.2.
   3. Provide at least two weeks written notice of date and time of tests and inspections.
   4. Supply instruments and execute specific tests.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch (6.4 mm) maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components and make ready for inspection.

3.08 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Location: At project site, unless noted otherwise.

3.09 PROTECTION

A. Protect installed products until date as established by the Owner.

B. Touch-up, repair, or replace damaged products and materials prior to the Date of Substantial Completion.

3.10 MAINTENANCE

A. Existing in-place elevator maintenance contract rights intended to continue for its remaining term.

B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 3 months from Date of Substantial Completion.

C. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.

D. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or installer.

E. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.

F. Examine system components monthly.

G. Include systematic examination, adjustment, and lubrication of elevator equipment. Maintain and repair or replace parts whenever required using parts produced by the original equipment manufacturer.

H. Perform work without removing cars from use during peak traffic periods.

I. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of hydraulic elevators will be measured for payment at the Contract unit price per Lump Sum.

4.02 PAYMENT

A. The accepted quantity of hydraulic elevators including full compensation for performing the work specified, including hydraulic elevators, and other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum.

Pay Item	Pay Unit
09 9600.01	Lump Sum

END OF SECTION

SECTION 22 0500
PLUMBING GENERAL PROVISIONS

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 SUMMARY

A. This Section includes Contract requirements and the following basic mechanical materials and methods to complement other Division 21, 22 and 23 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Concrete base construction requirements.
   4. Escutcheons.
   5. Dielectric fittings.
   6. Flexible connectors.
   7. Mechanical sleeve seals.
   8. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
   9. Nonshrink grout for equipment installations.
   10. Field-fabricated metal and wood equipment supports.
   11. Installation requirements common to equipment specification sections.
   12. Mechanical demolition.
   13. Cutting and patching.
   14. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 21, 22, and 23 piping system Sections.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The use of the word “Provide”: Whenever the word “Provide” is used in the specifications and/or on the drawings, it shall mean “furnish and install”, “connect”, “apply”, “erect”, “construct”, or similar terms, unless otherwise indicated.

G. The use of the word “Piping”: “Piping” shall include but not be limited to, in addition to piping or mains, all fittings, flanges, unions, valves, strainers, drains, traps, insulation, vents, hangers and other accessories relative to such piping.

H. The use of the word “Material”: Whenever the word material is used in the specifications and/or on the drawings, it shall mean any “product”, “equipment”, “device”, “assembly”, or “item” required under the contract, as indicated by trade or brand name, manufacturer’s name, standard specification reference or other description.

I. The term “Mechanical Contractor”, “HVAC Contractor”, “Plumbing Contractor” or “Contractor” refer to the Sub Contractor or his Sub Contractors responsible for the furnishing and installation of all work indicated on the Mechanical, HVAC, and/or Plumbing drawings and in the Mechanical, HVAC, and/or Plumbing Specifications.

J. The term “Accessible” indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, conduit, etc to gain access. “accessible ceiling” indicates acoustical tile type hung ceilings. Concealed spline or sheetrock ceilings with access panes shall not be considered accessible ceilings.

K. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. NP: Nylon plastic.
   4. PE: Polyethylene plastic.
   5. PVC: Polyvinyl chloride plastic.

L. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.04 CODES, STANDARDS, REFERENCES, AND PERMITS

A. All material and workmanship shall comply with all the latest editions of all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations.

B. In case of differences between the Building Codes, State Law, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the contractor shall promptly notify the Engineer in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern for budgetary and bid purposes. However, no work will proceed until the Engineer determines the correct method of installation.

D. Should the contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, the contractor shall bear all costs arising in correcting the deficiencies, as approved by the Engineer.

E. All potable water installations shall meet the following requirements: maximum weighted average lead content to 0.25 percent. This shall apply to pipes, fittings, fixtures, valves and other products that come in contact with drinking water

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Welding certificates.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.06 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.07 SYSTEM DESCRIPTION

A. Furnish and install all materials in order to provide functioning systems, upon completion, in compliance with all applicable codes, authorities having jurisdiction, manufacturer's requirements, performance requirements specified, and any modifications resulting from reviewed shop drawings and the field coordination drawings.

1.08 SCOPE OF WORK

A. The contractor is responsible for furnishing and installing all the devices and equipment shown indicated the Mechanical Drawings including materials and equipment required to create fully operational systems.

B. The contractor shall be responsible for reviewing the Architectural, Electrical, and Fire Protection Plans. In addition to all mechanical equipment, plumbing fixtures, and mechanical devices indicated on the Mechanical Plans, the contractor is responsible for mechanical installation of all the equipment and devices shown on the Architectural Plans and the Electrical Plans.

C. The contractor shall be responsible for reviewing the Architectural, Electrical, and Fire Protection Plans. Prior to bid, the contractor shall notify the Engineer of any discrepancies between the Architectural, Electrical, Mechanical, and Fire Protection Plans regarding equipment locations, equipment quantities, piping and duct work routing, device locations, light locations, chase locations, etc. otherwise it will be assumed the contractor is responsible for mechanical installation of all the equipment and devices shown on the Architectural Plans, Mechanical Plans, Plumbing Plans, Fire Protection Plans and the Electrical Plans regardless of whether they are indicated on the Mechanical Plans.

1.09 DRAWING INTERPRETATION

A. The project drawings are schematic in nature and indicate general arrangement of equipment. It is not the intent of the drawings to substitute for shop drawings. In many instances, equipment and devices are sized on one manufacturer's product. In the event of a field verification or coordination issue, report issue to Owners construction supervisor.

B. Piping and air duct plans are intended to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The drawings do not necessarily indicate all required offsets, details and accessories and equipment to be connected or encountered in the way of new work.

C. Generally, layout pipelines requiring drainage first, followed by large pipe mains, air duct and electrical conduit. Follow this procedure for an orderly installation but not to establish precedence of one trade over another. It must be understood that pipe and duct hanger installations must comply with seismic bracing requirements. Minimizing hanger lengths (structure to equipment and crossbars) to 12" and under minimizes the requirement for seismic bracing.

D. Install work as closely as possible to layouts shown on drawings. Modify work as necessary to meet job conditions and to clear other equipment. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines, to avoid existing field conditions as well as to maintain clearances to equipment whether or not indicated on the drawings. The contractor shall provide all drains, traps and accessories as required for his work to effect these offsets, transitions and changes in direction. Consult Design Professional before making changes that effect the function or appearance of systems.

E. Do not install equipment, air ducting or piping in a non-code compliant fashion due to drawing interpretation. Provide modification of illustrated work in order to accommodate job conditions at no cost to Owner.

F. In some cases, drawings are based on products of one or several manufacturers, as listed on the contract documents. The contractor shall be held responsible for modifications made necessary by substitution of products or other manufacturers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.11 COORDINATION

A. Do not install any part of a system until all critical components of the systems and related systems have been approved. Coordinate individual parts of systems.

B. Coordinate contract work with other work specified in other sections. Relocate work if required for proper installation and functioning of other systems, at no extra cost to the Owner.

C. Install products in accordance with manufacturer's instructions. Notify Design Professional if Contract Documents conflict with manufacturer's instructions. Comply with Design Professional's interpretations,

D. In general, air duct, heating and sprinkler piping, and drainage lines take precedence over water, gas, and electrical conduits. The design professional will final decisions regarding the arrangement of work, which cannot be agreed upon by the contractors.

1.12 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate 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 mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning before closing in building.

E. 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.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.13 "AS-BUILT" RECORD DRAWINGS

A. Record daily progress on one set of construction documents. Utilize a permanent black or blue marking media. All progress of record drawings shall be provided in a neat and accurate fashion.

B. As-built drawing reviews will be completed on a monthly basis by the engineer of record. Release of requisitions will be based on the regular progress of As-built drawings. The latest As-built drawings shall be submitted for review with each requisition for payment.

C. Formal As-built drawings shall be submitted for review at the completion of each phase of the work. The as-built drawings shall be ¼" scale and created in electronic format utilizing AUTOCAD Release 2004. At the completion of each phase of work, the mechanical contractor shall submit to the Engineer the original field progress as-built drawings, the electronic files of the formal as-built drawings, and four sets of final as-built drawings plotted on 24" x 36" 'D' sized sheets. Final payment for the phase of work and the start of the next phase shall be dependant of approval of the as-built drawings.

1.14 GUARANTEE

A. Provide written guarantee of all completed/installed work. Materials, equipment and workmanship shall be guaranteed for a minimum period of one year after Owners acceptance of work. Any failure due to defective material, equipment or workmanship shall be corrected at no additional cost to owner. This shall include damage completed to other areas of construction or facility resulting from this failure. Provide correction of any failure within an acceptable/reasonable time period.

B. Provide all equipment and material manufacturers guarantees and/or warranties to owner after acceptance of installation.

1.15 OPERATING AND MAINTENANCE MANUALS

A. Provide operating and maintenance information for all equipment, devices, systems, and materials. This shall include all maintenance and operations procedures, recommendations, and service requirements. All submitted data must include minimum equipment/device operations and maintenance requirements to fulfill manufacturers warrantees.

B. Submit all engineering selection and specification documentation with operating and maintenance information for all equipment, devices, systems, and materials.

C. Submit all data media in a detailed, organized, and complete manner. Provide a minimum of three copies to Owners construction supervisor for engineer/architect review. Submit in 3 ring bound enclosure.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual Division 21, 22, and 23 piping Sections for pipe and fitting materials and joining methods.

2.02 JOINING MATERIALS

A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.03 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
   2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
   3. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.04 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Dielectric unions: Dielectric unions are not acceptable.

C. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

D. Insulating Material: Suitable for system fluid, pressure, and temperature.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.05 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 250-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS and Smaller: Threaded.
   2. 2-1/2-Inch NPS and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.06 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.07 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
   4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: Split casting, with concealed hinge and set screw.
      a. Finish: Rough brass.
      b. Finish: Polished chrome-plate.

2.08 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psig, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PLUMBING DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Disconnect, demolish, and remove Work specified in Division 21, 22, and 23 Drawings and Sections.

E. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

F. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

G. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

H. Removal: Remove indicated equipment from Project site.

I. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
      g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes with smooth concrete bore.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      d. Seal space outside of sleeve fittings with grout.
   4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
   3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

F. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

G. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.06 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:
1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.07 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Provide 2” chamfered edges on top of concrete pads. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete." Provide broom finish.

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.09 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

C. Mechanical Contractor shall be responsible for any patching of existing partitions after removal of duct work and HVAC piping.

D. The Plumbing Contractor Shall be responsible for any patching of existing partitions after removal of plumbing piping.

3.11 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.12 FIRESTOPPING

A. The mechanical contractor is responsible for providing proper U.L. Listed firestopping and smokestopping for all duct, pipe, controls conduit, and related electrical conduit installed by the mechanical contractor.

B. The mechanical contractor shall utilize the latest fire and smoke protection materials and installation methods. The mechanical contractor shall guarantee that all materials installed are fire and smoke stopped per U.L. Listing, NFPA, building code requirements.

C. The mechanical contractor shall utilize Architectural Life Safety Drawings to identify partition ratings. If the mechanical contractor is unsure of partition rating then he or she must inquire to Construction Manager.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. The quantity of (Demolition of Above Grade Piping 2-3 1/2") will be measured for payment at the Contract unit price per linear foot.

B. The quantity of (Demolition of Above Grade Piping 4-6") will be measured for payment at the Contract unit price per linear foot.

C. The quantity of (Demolition of Above Grade Parking Drain) will be measured for payment at the Contract unit price per each.

D. The quantity of (Demolition of Slab on Grade Parking Drain) will be measured for payment at the Contract unit price per each.

E. The quantity of (Existing Level 1 Cherry St. Trench Drain Demolition) will be measured for payment at the Contract unit price per each.

F. The Elevator Machine Room Mechanical and Plumbing Scope will be measured for payment at a Contract unit price per Lump Sum. See Section 230500.

4.02 PAYMENT

A. The accepted quantity of (Demolition of Above Grade Piping 2-3 1/2") including full compensation for removal, preparation, disposal and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
220500.11	Linear Foot

B. The accepted quantity of (Demolition of Above Grade Piping 4-6") including full compensation for removal, preparation, disposal and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
220500.12	Linear Foot

C. The accepted quantity of (Demolition of Above Grade Parking Drain) including full compensation for removal, preparation, disposal and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
220500.13	Each

D. The accepted quantity of (Demolition of Slab on Grade Parking Drain) including full compensation for removal, preparation, disposal and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
220500.14	Each

E. The accepted quantity of (Existing Level 1 Cherry St. Trench Drain Demolition) including full compensation for removal, preparation, disposal and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each. (Marketplace Garage Scope)

Pay Item	Pay Unit
220500.11	Each

F. See Section 230500 for (Elevator Machine Room Mecahnical and Plumbing Scope). (Marketplace Garage Scope)

END OF SECTION

SECTION 22 0548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Vibration isolators.

D. Seismic restraints.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
   a. For each seismic restraint calculation, utilize appropriate component importance factor, component response modification factor, and component amplification factor. Where vibration pad isolators are utilized, recommend and provide appropriate pad thickness and quantity. Where vibration isolators are utilized, recommend appropriate minimum deflection, and provide vibration isolators meeting this recommendation.
2. Seismic- Restraint Details:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

D. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.

E. Coordination Drawings: Show coordination of seismic bracing for Plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints

F. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions

1.04 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the International Building Code unless requirements in this Section are more stringent

1.05 PERFORMANCE REQUIREMENTS

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mason Industries: www.mason-ind.com.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.03 EQUIPMENT SUPPORT BASES

2.04 VIBRATION ISOLATORS

2.05 VIBRATION ISOLATORS

A. Open Spring Isolators:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

B. Restrained Open Spring Isolators:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   4. Restraint: Provide heavy mounting frame and limit stops.
   5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.
   6. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
   7. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   8. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
   9. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

C. Spring Hanger:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
   3. Misalignment: Capable of 20 degree hanger rod misalignment.
   4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

D. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
   2. Configuration: Single layer.
   3. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

E. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

F. Seismic Snubbers:
   1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
   2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.
   3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
   4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

D. Provide seismic snubbers for all equipment, piping, and ductwork mounted on isolators. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance. Other snubbers shall have clearance between 0.15 inch and 0.25 inch.

E. Piping Restraints: Comply with requirements in MSS SP-127.

F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.
   3. 10 inches Pipe Size and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 15 Section "Hydronic Piping" for piping flexible connections.

3.03 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

B. Test and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

3.04 SCHEDULES

A. Utilize most specific category below, where more than one applies. If equipment manufacturer recommendations vary from the requirements below, contact Engineer prior to proceeding.

B. Suspended Piping Location: All locations.
   1. Piping Type: All piping in equipment rooms and the first four hangers from vibrating equipment (within 30 feet). The first two hangers adjacent vibrating equipment shall be the pre-compressed type, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges with the piping system is filled. Utilize pre-compressed type for all isolated pipe hangers for piping NPS 4 and larger.
   2. Isolator Type: Spring Hangers with Vertical Limit Stops.

C. Supported Piping Location: All locations.
   1. Piping Type: All piping in equipment rooms and the first four hangers from vibrating equipment (within 30 feet). The first two hangers adjacent vibrating equipment shall be the pre-compressed type, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges when the piping system is filled. Utilize pre-compressed type for all isolated pipe hangers for piping NPS 4 and larger.
   2. Isolator Type: Freestanding Spring Isolators.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to other pay items.

4.02 PAYMENT

A. Incidental to other pay items.

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof and floor drains.

B. Cleanouts.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass per Unit Area and Evaluation of Conformity; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Project Record Documents: Record actual locations of trench drains, floor drains, and cleanouts., _____.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Josam Company: www.josam.com.
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Zurn Industries, Inc: www.zurn.com.
   4. Or Equal

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Basis of Design: Zurn Industries, Inc.; Model ZC-100-3NH-C-EA-GD-R
   3. Body: Lacquered cast iron with sump.
   4. Strainer: Removable galvanized cast iron dome with vandal proof screws.
   5. Accessories: Coordinate with roofing type, refer to Section _____:
      a. Membrane flange and membrane clamp with integral gravel stop.

b. Adjustable under deck clamp.
c. Roof sump receiver.
d. Adjustable extension sleeve for roof insulation.

C. Parking Area Drains:
1. Basis of Design: Zurn Industries, Inc.; Model Z533-4NH-C-G-Y
2. Grating Material and Style: Galvanized Cast Iron slotted grate.
3. Drain Diameter: 9 inch diameter drain.
4. Accessories: Sediment bucket, underdeck clamp, Galvanized cast iron.

D. Prefabricated Trench Drain (TD-1): Trench drain system assembled from modular channel sections made of HDPE complete with no-hub outlet, grate, and heavy duty frame. Channels shall have lockdown grates.
1. Basis of Design: Zurn Industries, Inc.; Model Z882-HDS-U4-HPD
2. Load Class: DIN 19580, Class B.
3. Grating Material and Style: Slotted Ductile Iron Grate.
4. Trench Width: 12 inches.
5. Trench Section Length: 36 inches and 96 inches.
6. Grating Support Rail: Stainless Steel

E. Floor Sink (FS-2):
1. Round lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, full grate.

2.03 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Or Equal

B. Cleanouts at Exterior Unsurfaced Areas (CO-1):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover. Suitable for garage traffic loads.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Excavate as required to determine/record elevations and sizes of all existing piping to be replaced. Submit this data to engineer and await direction before shipping new pipe systems to site or demolishing any existing pipe.

F. Fabricate/install painted steel frame to protect all vertical storm drain piping from garage traffic. Submit sketch showing proposed frame details.

G. Submit record drawings at 1/10" = 1'-0" scale showing actual locations, elevations, and sizes of installed storm drain piping, cleanouts, and trench/floor drains.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. The quantity of (New Above Grade Parking Drain 4") will be measured for payment at the Contract unit price per each.

B. The quantity of (New Above Grade Parking Trench Drain) will be measured for payment at the Contract unit price per each.

C. The quantity of (New Roof Drain 3") will be measured for payment at the Contract unit price per each.

D. The quantity of (New Slab on Grade Parking Drain 4") will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of (New Above Parking Drain 4") including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221006.11	Each

B. The accepted quantity of (New Above Parking Trench Drain) including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221006.12	Each

C. The accepted quantity of (New Roof Drain) including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221006.13	Each

D. The accepted quantity of (New Slab on Grade Parking Drain 4") including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221006.14	Each

END OF SECTION

SECTION 22 1009
STORM DRAINAGE PIPING

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 SUMMARY

A. This Section includes storm-drainage piping inside the building and to locations indicated.

B. Related Sections include the following:
   1. Division 22 Section "Plumbing Specialties" for storm drainage piping system specialties.

1.03 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
   1. Storm Drainage Piping: 20-foot head of water.

1.04 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 REFERENCE STANDARDS

A. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

B. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

C. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2012.

D. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

E. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2008.

F. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2010.

G. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

H. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

I. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.06 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.02 PVC PIPE AND FITTINGS, BURIED WITHIN 5 FEET OF THE BUILDING

A. Solid-Wall PVC Pipe: ASTM D 2665, Schedule 40, drain, waste, and vent.
   1. PVC Joints: Solvent welded, with ASTM D2564 solvent cement.

B. Solid-Wall PVC Pipe: ASTM D2665 Schedule 40 or ASTM D3034 SDR 35.
   1. PVC Joints: Push-on, using ASTM F477 elsastomeric gaskets.

2.03 PVC PIPE AND FITTINGS, ABOVE GRADE

A. Solid-Wall PVC Pipe: ASTM D 2665, Schedule 40, drain, waste, and vent.
   1. PVC Joints: Solvent welded, with ASTM D2564 solvent cement.

PART 3 EXECUTION

3.01 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground Storm Drainage Piping: Use the following piping materials for each size range:
   1. NPS 2 to NPS 4: Solid Wall PVC Piping, Schedule 40.
   2. NPS 5 and NPS 6: Solid Wall PVC Piping, Schedule 40.
   3. NPS 8: Solid Wall PVC Piping, Schedule 40.
   4. NPS 10: Solid Wall PVC Piping, Schedule 40.

D. Underground Storm Drainage Piping: Use the following piping materials for each size range:
   1. NPS 3 and NPS 4: Solid Wall PVC Piping, Schedule 40.
   2. NPS 5 and NPS 6: Solid Wall PVC Piping, Schedule 40.
   3. NPS 8 and NPS 10: Solid Wall PVC Piping, Schedule 40.

3.03 PIPING INSTALLATION

A. Refer to Division 33 Section "Site Storm Sewerage Systems" for Project site storm sewer and drainage piping.

B. Refer to Division 23 Section "Mechanical General Provisions" for basic piping installation.

C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 23 Section "Mechanical General Provisions" for sleeves and mechanical sleeve seals.

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Mechanical General Provisions" for wall penetration systems.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.

G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
   1. Building Storm Drain: ¼” per 1’-0”
   2. Horizontal Storm-Drainage Piping: ¼” per 1’-0”.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

3.04 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Plumbing General Provisions" for basic piping joint construction.

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.05 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Mechanical Vibration Controls and Seismic Restraints" for seismic-restraint devices.

B. Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
   6. NPS 15: 60 inches with 1-inch rod.
   7. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.07 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

3.08 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. The quantity of (New Above Grade PVC Piping & Couplings 3") will be measured for payment at the Contract unit price per linear foot.

B. The quantity of (New Above Grade PVC Piping & Couplings 4") will be measured for payment at the Contract unit price per linear foot.

C. The quantity of (New Above Grade PVC Piping & Couplings 5") will be measured for payment at the Contract unit price per linear foot.

D. The quantity of (PVC 1/4 Bend 3") will be measured for payment at the Contract unit price per each.

E. The quantity of (PVC 1/4 Bend 4") will be measured for payment at the Contract unit price per each.

F. The quantity of (PVC 1/4 Bend 6") will be measured for payment at the Contract unit price per each.

G. The quantity of (PVC 1/8 Bend 4") will be measured for payment at the Contract unit price per each.

H. The quantity of (PVC 1/8 Bend 6") will be measured for payment at the Contract unit price per each.

I. The quantity of (PVC Combination Wye & 1/8th Bend 3") will be measured for payment at the Contract unit price per each.

J. The quantity of (PVC Combination Wye & 1/8th Bend 4") will be measured for payment at the Contract unit price per each.

K. The quantity of (PVC Combination Wye & 1/8th Bend 6") will be measured for payment at the Contract unit price per each.

L. The quantity of (PVC Wye 4") will be measured for payment at the Contract unit price per each.

M. The quantity of (PVC Double Wye 4") will be measured for payment at the Contract unit price per each.

N. The quantity of (New Level 1 Cherry St. Trench Drain) will be measured for payment at the Contract unit price per each.

4.02 PAYMENT

A. The accepted quantity of (New Above Grade PVC Piping & Couplings 3") including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221009.11	Linear Foot

B. The accepted quantity of (New Above Grade PVC Piping & Couplings 4") including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221009.12	Linear Foot

C. The accepted quantity of (New Above Grade PVC Piping & Couplings 5") including full compensation for routing, preparing and sealing and supporting the piping and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
221009.13	Linear Foot

D. The accepted quantity of (PVC 1/4 Bend 3") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit

221009.14	Each

E. The accepted quantity of (PVC 1/4 Bend 4") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.15	Each

F. The accepted quantity of (PVC 1/4 Bend 6") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.16	Each

G. The accepted quantity of (PVC 1/8 Bend 4") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.17	Each

H. The accepted quantity of (PVC 1/8 Bend 6") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.18	Each

I. The accepted quantity of (PVC Combination Wye & 1/8th Bend 3") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.19	Each

J. The accepted quantity of (PVC Combination Wye & 1/8th Bend 4") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.01	Each

K. The accepted quantity of (PVC Combination Wye & 1/8th Bend 6") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.02	Each

L. The accepted quantity of (PVC Wye 4") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.03	Each

M. The accepted quantity of (PVC Double Wye 4") including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each.

Pay Item	Pay Unit
221009.04	Each

N. The accepted quantity of (New Level 1 Cherry St. Trench Drain) including full compensation for preparing and sealing and supporting the pipe fitting and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per each. (Marketplace Garage Scope)

Pay Item	Pay Unit
221009.11	Each

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pumps.
   1. Sump Pumps.

1.02 RELATED REQUIREMENTS

A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2013.

B. ICC (IPC) - International Plumbing Code; 2012.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 CERTIFICATIONS

1.08 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
   1. Armstrong Pumps Inc; Model _____: www.armstrongpumps.com.
   2. Goulds Pumps; Model _____: www.goulds.com.
   3. Zoeller Pump Company; Model 53: www.zoeller.com.

B. Type: Completely submersible, vertical, centrifugal.

C. Casing: Cast iron pump body and oil filled motor chamber.

D. Impeller: Engineered, glass-filled, plastic impeller with metal insert.

E. Bearings: Lower & upper oil fed cast iron.

F. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

G. Controls: Pump shall have piggyback variable level float switch with high level alarm float. Pump shall be controlled by an alarm panel to provide both local alarm and a dry contact to alarm to the DDC system.

H. Performance:
   1. Flow: 20 gpm, at 15 feet lift.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Pumps:
   1. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
   2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to other pay items.

4.02 PAYMENT

A. Incidental to other pay items.

END OF SECTION

SECTION 23 0500
MECHANICAL GENERAL PROVISIONS

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.

B. Section 07 84 00 Firestopping.

C. Division 23 00 00 Heating, Ventilating and Air Conditioning.

D. Division 25 00 00 Integrated Automation.

1.02 SUMMARY

A. This Section includes Contract requirements and the following basic mechanical materials and methods to complement other Division 21, 22, 23 and 25 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Concrete base construction requirements.
   4. Escutcheons.
   5. Dielectric fittings.
   6. Flexible connectors.
   7. Mechanical sleeve seals.
   8. Equipment nameplate data requirements.
   9. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Mechanical Identification."
   10. Nonshrink grout for equipment installations.
   11. Field-fabricated metal and wood equipment supports.
   12. Installation requirements common to equipment specification sections.
   13. Mechanical demolition.
   14. Cutting and patching.
   15. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 21, 22, and 23 piping system Sections.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The use of the word “Provide”: Whenever the word “Provide” is used in the specifications and/or on the drawings, it shall mean “furnish and install”, “connect”, “apply”, “erect”, “construct”, or similar terms, unless otherwise indicated.

G. The use of the word “Piping”: “Piping” shall include but not be limited to, in addition to piping or mains, all fittings, flanges, unions, valves, strainers, drains, traps, insulation, vents, hangers and other accessories relative to such piping.

H. The use of the word “Material”: Whenever the word material is used in the specifications and/or on the drawings, it shall mean any “product”, “equipment”, “device”, “assembly”, or “item” required under the contract, as indicated by trade or brand name, manufacturer’s name, standard specification reference or other description.

I. The term “Mechanical Contractor”, “HVAC Contractor”, “Plumbing Contractor” or “Contractor” refer to the Sub Contractor or his Sub Contractors responsible for the furnishing and installation of all work indicated on the Mechanical, HVAC, and/or Plumbing drawings and in the Mechanical, HVAC, and/or Plumbing Specifications.

J. The term “Accessible” indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, conduit, etc to gain access. “accessible ceiling” indicates acoustical tile type hung ceilings. Concealed spline or sheetrock ceilings with access panes shall not be considered accessible ceilings.

K. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. NP: Nylon plastic.
   4. PE: Polyethylene plastic.
   5. PVC: Polyvinyl chloride plastic.

L. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.04 CODES, STANDARDS, REFERENCES, AND PERMITS

A. All material and workmanship shall comply with all the latest editions of all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations.

B. In case of differences between the Building Codes, State Law, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the contractor shall promptly notify the Engineer in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern for budgetary and bid purposes. However, no work will proceed until the Engineer determines the correct method of installation.

D. Should the contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, the contractor shall bear all costs arising in correcting the deficiencies, as approved by the Engineer.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Firestopping materials.

C. Welding certificates.

D. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.06 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.07 SYSTEM DESCRIPTION

A. Furnish and install all materials in order to provide functioning systems, upon completion, in compliance with all applicable codes, authorities having jurisdiction, manufacturer's requirements, performance requirements specified, and any modifications resulting from reviewed shop drawings and the field coordination drawings.

1.08 SCOPE OF WORK

A. The contractor is responsible for furnishing and installing all the devices and equipment shown indicated the Mechanical Drawings including materials and equipment required to create fully operational systems.

B. The contractor shall be responsible for reviewing the Architectural, Electrical, and Fire Protection Plans. In addition to all mechanical equipment, plumbing fixtures, and mechanical devices indicated on the Mechanical Plans, the contractor is responsible for mechanical installation of all the equipment and devices shown on the Architectural Plans and the Electrical Plans.

C. The contractor shall be responsible for reviewing the Architectural, Electrical, and Fire Protection Plans. Prior to bid, the contractor shall notify the Engineer of any discrepancies between the Architectural, Electrical, Mechanical, and Fire Protection Plans regarding equipment locations, equipment quantities, piping and duct work routing, device locations, light locations, chase locations, etc. otherwise it will be assumed the contractor is responsible for mechanical installation of all the equipment and devices shown on the Architectural Plans, Mechanical Plans, Plumbing Plans, Fire Protection Plans and the Electrical Plans regardless of whether they are indicated on the Mechanical Plans.

1.09 DRAWING INTERPRETATION

A. The project drawings are schematic in nature and indicate general arrangement of equipment. It is not the intent of the drawings to substitute for shop drawings. In many instances, equipment and devices are sized on one manufacturer's product. In the event of a field verification or coordination issue, report issue to Owners construction supervisor.

B. Piping and air duct plans are intended to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The drawings do not necessarily indicate all required offsets, details and accessories and equipment to be connected or encountered in the way of new work.

C. Generally, layout pipelines requiring drainage first, followed by large pipe mains, air duct and electrical conduit. Follow this procedure for an orderly installation but not to establish precedence of one trade over another. It must be understood that pipe and duct hanger installations must comply with seismic bracing requirements. Minimizing hanger lengths (structure to equipment and crossbars) to 12" and under minimizes the requirement for seismic bracing.

D. Install work as closely as possible to layouts shown on drawings. Modify work as necessary to meet job conditions and to clear other equipment. Offsets, transitions and changes of direction

in all systems shall be made as required to maintain proper headroom and pitch of sloping lines, to avoid existing field conditions as well as to maintain clearances to equipment whether or not indicated on the drawings. The contractor shall provide all drains, traps and accessories as required for his work to effect these offsets, transitions and changes in direction. Consult Design Professional before making changes that effect the function or appearance of systems.

E. Do not install equipment, air ducting or piping in a non-code compliant fashion due to drawing interpretation. Provide modification of illustrated work in order to accommodate job conditions at no cost to Owner.

F. In some cases, drawings are based on products of one or several manufacturers, as listed on the contract documents. The contractor shall be held responsible for modifications made necessary by substitution of products or other manufacturers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.11 COORDINATION

A. Do not install any part of a system until all critical components of the systems and related systems have been approved. Coordinate individual parts of systems.

B. Coordinate contract work with other work specified in other sections. Relocate work if required for proper installation and functioning of other systems, at no extra cost to the Owner.

C. Install products in accordance with manufacturer's instructions. Notify Design Professional if Contract Documents conflict with manufacturer's instructions. Comply with Design Professional's interpretations,

D. In general, air duct, heating and sprinkler piping, and drainage lines take precedence over water, gas, and electrical conduits. The design professional will final decisions regarding the arrangement of work, which cannot be agreed upon by the contractors.

1.12 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate 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 mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning before closing in building.

E. 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.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.13 "AS-BUILT" RECORD DRAWINGS

A. Record daily progress on one set of construction documents. Utilize a permanent black or blue marking media. All progress of record drawings shall be provided in a neat and accurate fashion.

B. As-built drawing reviews will be completed on a monthly basis by the engineer of record. Release of requisitions will be based on the regular progress of As-built drawings. The latest As-built drawings shall be submitted for review with each requisition for payment.

C. Formal As-built drawings shall be submitted for review at the completion of each phase of the work. The as-built drawings shall be ¼" scale and created in electronic format utilizing AUTOCAD Release 2004. At the completion of each phase of work, the mechanical contractor shall submit to the Engineer the original field progress as-built drawings, the electronic files of the formal as-built drawings, and four sets of final as-built drawings plotted on 24" x 36" 'D' sized sheets. Final payment for the phase of work and the start of the next phase shall be dependant of approval of the as-built drawings.

1.14 GUARANTEE

A. Provide written guarantee of all completed/installed work. Materials, equipment and workmanship shall be guaranteed for a minimum period of one year after Owners acceptance of work. Any failure due to defective material, equipment or workmanship shall be corrected at no additional cost to owner. This shall include damage completed to other areas of construction or facility resulting from this failure. Provide correction of any failure within an acceptable/reasonable time period.

B. Provide all equipment and material manufacturers guarantees and/or warranties to owner after acceptance of installation.

1.15 OPERATING AND MAINTENANCE MANUALS

A. Provide operating and maintenance information for all equipment, devices, systems, and materials. This shall include all maintenance and operations procedures, recommendations, and service requirements. All submitted data must include minimum equipment/device operations and maintenance requirements to fulfill manufacturers warrantees.

B. Submit all engineering selection and specification documentation with operating and maintenance information for all equipment, devices, systems, and materials.

C. Submit all data media in a detailed, organized, and complete manner. Provide a minimum of three copies to Owners construction supervisor for engineer/architect review. Submit in 3 ring bound enclosure.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual Division 21, 22, and 23 piping Sections for pipe and fitting materials and joining methods.

2.02 JOINING MATERIALS

A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.03 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
   2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
   3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.04 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Dielectric unions: Dielectric unions are not acceptable.

C. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

D. Insulating Material: Suitable for system fluid, pressure, and temperature.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.05 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 250-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS and Smaller: Threaded.
   2. 2-1/2-Inch NPS and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.06 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.07 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
   4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: Split casting, with concealed hinge and set screw.
      a. Finish: Rough brass.
      b. Finish: Polished chrome-plate.

2.08 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psig, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 MECHANICAL DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Disconnect, demolish, and remove Work specified in Division 21, 22, and 23 Drawings and Sections.

E. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

F. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

G. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

H. Removal: Remove indicated equipment from Project site.

I. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
      e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
      f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
      g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes with smooth concrete bore.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
d. Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials. Firestop ID signage is required.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

F. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

G. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.06 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
   5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.07 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Provide 2” chamfered edges on top of concrete pads. Follow

supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete." Provide broom finish.

B. The mechanical contractor shall fill each air handling unit fan inertia base with cast-in-place concrete. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.08 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.09 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

C. Mechanical Contractor shall be responsible for any patching of existing partitions after removal of duct work and HVAC piping.

D. The Plumbing Contractor Shall be responsible for any patching of existing partitions after removal of plumbing piping.

3.11 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.12 FIRESTOPPING

A. Comply with requirements of Division 7.

B. The mechanical contractor is responsible for providing proper U.L. Listed firestopping and smokestopping for all duct, pipe, controls conduit, and related electrical conduit installed by the mechanical contractor.

C. The mechanical contractor shall utilize the latest fire and smoke protection materials and installation methods. The mechanical contractor shall guarantee that all materials installed are fire and smoke stopped per U.L. Listing, NFPA, building code requirements.

D. The mechanical contractor shall utilize Architectural Life Safety Drawings to identify partition ratings. If the mechanical contractor is unsure of partition rating then he or she must inquire to Construction Manager.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. The quantity of (Elevator Machine Room Mechanical and Plumbing Scope) will be measured for payment at the Contract unit price per Lump Sum.

B. The quantity of (Remove Existing 4" Abandoned Ductwork) will be measured for payment at the Contract unit price per Lump Sum.

4.02 PAYMENT

A. The accepted quantity of (Elevator Machine Room Mechanical and Plumbing Scope) including full compensation for demolition of existing equipment, installation of new equipment including routing, preparing, supporting, insulating, connecting, programming and finishing the entirety of the Machine Room scope of work for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum. (Marketplace Garage Scope)

Pay Item	Pay Unit
230500.11	Lump Sum

B. The accepted quantity of (Remove Existing 4" Abandoned Ductwork) including full compensation for demolition of section of ductwork, preparation for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum. (Marketplace Garage Scope)

Pay Item	Pay Unit
230500.12	Lump Sum

END OF SECTION

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 26 2717 - EQUIPMENT WIRING: Electrical characteristics and wiring connections.

B. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lincoln Motors: www.lincolnmotors.com.

B. A. O. Smith Electrical Products Company: www.aosmithmotors.com.

C. Reliance Electric/Rockwell Automation: www.reliance.com.

D. Or Equal

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 1/2 Horsepower: 208 or 480 volts, three phase, 60 Hz.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Motors 1/2 HP and Larger: Three Phase

B. Motors 1/3 HP and Smaller: Single Phase

C. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

D. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: ECM type.

E. Single phase motors for shaft mounted fans or blowers: ECM type.

F. Single phase motors for fans, pumps, blowers, and air compressors: ECM type.

G. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - ELECRONICALLY COMMUTATED MOTOR

A. Motors: Built-in inverter and a magnet rotor.

B. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

C. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

B. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

C. Insulation System: NEMA Class B or better.

D. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

E. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Sound Power Levels: To NEMA MG 1.

H. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

I. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SCHEDULE

A. NEMA Open Motor Service Factors.
   1. 1/6-1/3 hp:
      a. 1800 rpm: 1.35.
   2. 1/2 hp:
      a. 1800 rpm: 1.25.
   3. 3/4 hp:
      a. 1800 rpm: 1.25.
   4. 1 hp:
      a. 1800 rpm: 1.15.
   5. 1.5-150 hp:
      a. 1800 rpm: 1.15.

B. Three Phase - Energy Efficient, Open Drip-Proof Performance:
   1. 1800 rpm.
      a. 1 hp:
         1) NEMA Frame: 143T.
         2) Minimum Percent Efficiency: 85.5.
      b. 1-1/2 hp:
         1) NEMA Frame: 145T.
         2) Minimum Percent Efficiency: 86.5.
      c. 2 hp:
         1) NEMA Frame: 145T.
         2) Minimum Percent Efficiency: 86.5.
      d. 3 hp:
         1) NEMA Frame: 182T.
         2) Minimum Percent Efficiency: 89.5.
      e. 5 hp:
         1) NEMA Frame: 184T.
         2) Minimum Percent Efficiency: 89.5.
      f. 7-1/2 hp:

1) NEMA Frame: 213T.
2) Minimum Percent Efficiency: 91.7.

g. 10 hp:
1) NEMA Frame: 215T.
2) Minimum Percent Efficiency: 91.7.

h. 15 hp:
1) NEMA Frame: 256T.
2) Minimum Percent Efficiency: 92.4.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Seismic restraints for suspended components and equipment..

D. Roof curbs.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2011.

C. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

D. SMACNA (SRM) - Seismic Duct Restraint Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.
   2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.

C. Shop Drawings:
   1. Provide schedule of vibration isolator type with location and load on each.
   2. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
   3. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
   4. Include the seal of the Professional Structural Engineer registered in the State of Vermont in which the Project is located, on the drawings and calculations which at a minimum include the following:
      a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.

D. Product Data:
   1. Provide schedule of vibration isolator type with location and load on each.
   2. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.

E. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
      a. For each seismic restraint calculation, utilize appropriate component importance factor, component response modification factor, and component amplification factor. Where vibration pad isolators are utilized, recommend and provide appropriate pad thickness and quantity. Where vibration isolators are utilized, recommend appropriate minimum deflection, and provide vibration isolators meeting this recommendation.
   2. Seismic- Restraint Details:
      a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
      c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

F. Coordination Drawings: Show coordination of seismic bracing for Plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

G. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.05 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.06 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the International Building Code unless requirements in this Section are more stringent

1.07 PERFORMANCE REQUIREMENTS

A. Seismic Restraint Loading:
   1. Site Class as Defined in International Building Code: Site Class B
   2. Importance Factor: 1.0
   3. Assigned Seismic Use Group or Building Category as Defined in International Building Code: II
   4. Seismic Design Category: C
   5. Design Spectral Response Acceleration at Short Periods (0.2 second): 0.292g.
   6. Design Spectral Response Acceleration at 1-Second Period: 0.151g.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mason Industries: www.mason-ind.com.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.

2.03 EQUIPMENT SUPPORT BASES

A. Structural Bases:
   1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
   2. Frames: Square, rectangular or T-shaped.
   3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

2.04 VIBRATION ISOLATORS

A. Non-Seismic Type:
   1. Steel Springs:
      a. Assembly: Freestanding, laterally stable without housing.
      b. Leveling Device: Rigidly connected to equipment or frame.
   2. Spring Hanger:
      a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
   3. Combination Elastomeric-Spring Hanger:
      a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

2.05 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:
   1. ASHRAE Handbook - HVAC Applications
   2. SMACNA - Seismic Duct Restraint Manual

B. All Directional External:
   1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
   2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
   3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
   4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

2.06 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:
   1. ASHRAE Handbook - HVAC Applications
   2. SMACNA - Seismic Duct Restraint Manual

B. Cable Restraints:
   1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
   2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.

3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:
   a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
   b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:
1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

2.07 ROOF CURBS

A. Vibration Isolation Curbs:
1. Non-Seismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Aluminum.
   c. Integral vibration isolation to conform to requirements of this section.
   d. Weather exposed components consist of corrosion resistant materials.
2. Seismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Steel.
   c. Integral vibration isolation to conform to requirements of this section.
   d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
   e. Weather exposed components consist of corrosion resistant materials.

2.08 VIBRATION ISOLATORS

A. Open Spring Isolators:
1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

B. Restrained Open Spring Isolators:
1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

4. Restraint: Provide heavy mounting frame and limit stops.
5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

C. Spring Hangers:
1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
3. Misalignment: Capable of 20 degree hanger rod misalignment.
4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

D. Neoprene Pad Isolators:
1. Configuration: Single layer.
2. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

E. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

F. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.
3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

G. Roof Mounting Curb: 24 inches high with rigid steel lower section containing adjustable spring pockets with restrained spring isolators, steel upper section to support rooftop equipment, and continuous elastomeric membrane extending from upper section for counterflashing over roofing. Provide acoustical package consisting of interior perimeter angles and cross members to support up to two layers of gypsum board.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
1. Adjust equipment level.

C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

D. Piping Restraints: Comply with requirements in MSS SP-127.

3.02 INSTALLATION - SEISMIC

A. Comply with:
1. ASHRAE Handbook - HVAC Applications
2. SMACNA - Seismic Duct Restraint Manual

B. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:
1. Install equipment anchorage items designed to resist seismic design force in any direction.

C. Suspended Mechanical Equipment:
1. Provide supports and bracing to resist seismic design force in any direction.
2. Provide flexible connections between equipment and interconnected piping.

D. Piping:

1. Provide seismic bracing in accordance ASC 7.
2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.
4. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.
5. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
   a. Provide transverse bracing at spacing not more than 40.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.
6. Pipes and Connections Constructed of Non Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe):
   a. Provide transverse bracing at spacing not more than 20.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.
7. Piping Explicitly Exempt from Seismic Bracing Requirements:
   a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
   b. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
   c. Provide swing restraints as required to control potential impact due to limited space between subject components.
8. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.
9. Re-use of Existing Hangers:
   a. Re-using existing hangers at locations of seismic bracing are to be judged on a case-by-case basis by the registered project design professional.
   b. Unless otherwise shown on the drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.

E. Ductwork:
1. Provide seismic bracing for ducts with cross sectional area greater than 6 sq ft (independent of duct contents).
2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
3. Independently support in-line devices weighing more than 20 pounds.
4. Independently support and brace all in-line devices weighing more than 75 pounds.
5. Provide unbraced piping attached to braced in-line equipment with adequate flexibility to accommodate differential displacements.
6. Positively attach dampers, louvers, diffusers and similar appurtenances to ductwork with mechanical fasteners.
7. Install duct supports designed to resist not less than 150 percent of the duct weight.
8. The use of power driven fasteners is prohibited in the hanging of ducts weighing over 10 pounds per lineal foot for seismic design categories D, E, and F.
9. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an IAS AC172 accredited inspection body or otherwise accepted by applicable codes is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

F. Tanks:
1. Install tank anchorage, tank legs and/or supporting structure designed to resist design force.
2. Provide flexible connections between tank and interconnected piping.

G. Install cables so they do not bend across edges of adjacent equipment or building structure.

H. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction providing required submittals for component.

I. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 15 Section "Hydronic Piping" for piping flexible connections.

3.04 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

B. Test and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
   3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   6. Measure isolator restraint clearance.
   7. Measure isolator deflection.
   8. Verify snubber minimum clearances.
   9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

3.05 SCHEDULE

A. Utilize most specific category below, where more than one applies. If equipment manufacturer recommendations vary from the requirements below, contact Engineer prior to proceeding.

B. Suspended Piping Location: All locations.
   1. Piping Type: All piping in equipment rooms and the first four hangers from vibrating equipment (within 30 feet). The first two hangers adjacent vibrating equipment shall be the pre-compressed type, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges with the piping system is filled. Utilize pre-compressed type for all isolated pipe hangers for piping NPS 4 and larger.
   2. Isolator Type: Spring Hangers with Vertical Limit Stops.

C. Supported Piping Location: All locations.
   1. Piping Type: All piping in equipment rooms and the first four hangers from vibrating equipment (within 30 feet). The first two hangers adjacent vibrating equipment shall be the pre-compressed type, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges when the piping system is filled. Utilize pre-compressed type for all isolated pipe hangers for piping NPS 4 and larger.
   2. Isolator Type: Freestanding Spring Isolators.

D. Suspended Ductwork and Boiler Flue Location: All locations.
   1. Type: All ductwork and boiler flues. Utilize pre-compressed type for all isolated hangers, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges/connections.
   2. Isolator Type: Spring Hangers with Vertical Limit Stops.

E. Supported Ductwork and Boiler Flue Location: All locations.
   1. Type: All ductwork and boiler flues. Utilize pre-compressed type for all isolated hangers, pre-compressed to the cold load position by use of travel stops, to prevent load transfer to equipment flanges/connections.
   2. Isolator Type: Freestanding Spring Isolators

F. Roof Mounted Equipment: All Locations.
   1. Type: All roof mounted air handling equipment and exhaust fans. Utilize vibration isolated roof curb with seismic restraints.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping.

C. Section 23 0553 - Identification for HVAC Piping and Equipment.

D. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 1985 (Reapproved 2007).

E. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.

F. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2013.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

K. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. Knauf Insulation; _____: www.knaufusa.com.
2. Johns Manville; _____: www.jm.com.
3. Owens Corning Corporation; _____: www.ocbuildingspec.com.
4. Or Equal

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Density: 1.5 lb/cu. ft.
3. Maximum Service Temperature: 1200 degrees F.
4. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
1. Knauf Insulation; _____: www.knaufusa.com.
2. Johns Manville; _____: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. Or Equal

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum service temperature: 450 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent.
4. Minimum Density: 3.0 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:
a. Compatible with insulation.

B. EPDM Membrane (Outdoor) Jacket: ASTM D 4637, Type I, non-reinforced uniform, flexible EPDM sheet.
1. Thickness: 90 mils
2. Exposed Face Color: White on black.

2.05 DUCT LINER

A. Manufacturers:
1. Armstrong World Industries, Inc.
2. KFlex USA

B. Flexible Elastomeric Duct Liner: Comply with NFPA 90A or NFPA 90B.
1. Materials: Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.
2. Thickness: 1/2 inch.
3. Thermal Conductivity (k-Value): 0.24 at 75 deg F mean temperature.
4. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
6. Fungi Resistance: ASTM G 21.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with EPDM jacket..

3.03 SCHEDULES

Service	Location	Size	Insulation Type	Insulation Thickness	Insulation Jacket
Rectangular Supply Air Ductwork	Interior, Exposed	All Sizes	Rigid Glass Fiber	1"	Vapor Barrier Jacket
Rectangular Exhaust Air Ductwork	Interior, Exposed	All Sizes	Rigid Glass Fiber	1"	Vapor Barrier Jacket

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping.

C. Section 09 9123 - Interior Painting: Painting insulation jacket.

D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

E. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2013.

I. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.

J. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 2010.

K. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

M. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

N. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc
   2. Armacell LLC
   3. Or Equal

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Note: The insulation product shall comply with the maximum service temperature of the VRF system. Coordinate maximum service temperature with manufacturer's product data of the selected system. If the system exceeds 220 degrees F, the insulation shall be substituted for EPDM closed cell pipe insulation comparable to Aerocel by Aeroflex. The same insulation values shall apply, but the insulation shall be installed to comply with the maximum service temperature of the VRF system.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville.
      b. Or Equal
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 110 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 110 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. Heating Systems:

Service	Size	Minimum Tickness	Insulation Type
Glycol Piping Supply & Return (to 200 degrees F)	1-1/2" and Larger	2"	Glass Fiber
Refrigerant Piping (Low Pressure)	All Sizes	1"	Flexible Elastomeric Cellular Insulation
Refrigerant Piping (High Pressure)	All Sizes	1"	Flexible Elastomeric Cellular Insulation
Refrigerant Piping (Liquid)	All Sizes	1"	Flexible Elastomeric Cellular Insulation

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Filter-driers.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 09 9123 - Interior Painting.
C. Section 22 0719 - Plumbing Piping Insulation.
D. Section 22 0716 - Plumbing Equipment Insulation.
E. Section 23 0716 - HVAC Equipment Insulation.
F. Section 23 0719 - HVAC Piping Insulation.
G. Section 237313 - Custom Air-Handling Units
H. Section 23 8216 - Air Coils.
I. Section 26 2717 - EQUIPMENT WIRING: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; Air-Conditioning, Heating, and Refrigeration Institute; 2009.
B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013 (ANSI/ASHRAE Std 15).
C. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013.
D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2013.
E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; The American Society of Mechanical Engineers; 2013.
F. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2013.
G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2013.
H. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.
I. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011-AMD 1.
K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

L. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

M. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.

D. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

G. Submit welders certification of compliance with ASME BPVC-IX.

H. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

I. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.5 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B 280, ACR drawn temper (hard)Type O annealed copper pipe.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Conform to ASME B31.5.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Vertical Support: Steel riser clamp.
   4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   5. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   6. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
   7. Rooftop Supports for Low-Slope Roofs: Except where detail provided otherwise, provide steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.02 REFRIGERANT

A. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.

2.03 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 VALVES

A. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

B. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

D. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.05 STRAINERS

A. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.06 CHECK VALVES

A. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

B. Straight Through Type:
   1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.07 FILTER-DRIERS

A. Performance:
   1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   2. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

6. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

J. Flood piping system with nitrogen when brazing.

K. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 9123.

L. Insulate piping and equipment; refer to Section and Section 23 0716.

M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

N. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

O. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

P. Fully charge completed system with refrigerant after testing.

Q. Provide electrical connection to solenoid valves. Refer to Section 26 2717.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping.

C. Section 23 0130.51 - HVAC Air Duct Cleaning: Cleaning ducts after completion of installation.

D. Section 23 0713 - Duct Insulation: External insulation and duct liner.

E. Section 23 3300 - Air Duct Accessories.

F. Section 23 3700 - Air Outlets and Inlets.

G. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2014a.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

F. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

G. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

H. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

I. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

L. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

M. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

N. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

O. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Firestopping materials.

D. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum ___ years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.07 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

B. All Ducts: Galvanized steel, unless otherwise indicated.

C. Ventilation Supply: 4 inch w.g. pressure class, galvanized steel.

D. Ventilation Air Return: 4 inch w.g. pressure class, galvanized steel.

E. Ventilation Air Exhaust: 4 inch w.g. pressure class, galvanized steel.

F. Ventilation Air Outdoor Air: 4 inch w.g. pressure class, galvanized steel.

G. Terminal Unit Supply: 4 inch w.g. pressure class, galvanized steel.

H. Terminal Unit Return: 4 inch w.g. pressure class, galvanized steel.

I. Exhaust: 4 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

C. Stainless Steel for Ducts: ASTM A480/A480M, Type 304.

D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
   4. For Use With Flexible Ducts: UL labeled.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 10 degrees F to 160 degrees F.

B. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 8 inches WG positive or negative.
   3. Maximum Velocity: 5000 fpm.
   4. Temperature Range: Minus 20 degrees F to 250 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with adhesive.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with

spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

3.02 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness, except where access panels are required.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.03 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Supply-Air Ducts: Seal Class A.
   3. Exhaust Ducts: Seal Class A.
   4. Return-Air Ducts: Seal Class A.
   5. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   6. Unconditioned Space, Exhaust Ducts: Seal Class A.
   7. Unconditioned Space, Return-Air Ducts: Seal Class A.
   8. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   9. Conditioned Space, Exhaust Ducts: Seal Class A.
   10. Conditioned Space, Return-Air Ducts: Seal Class A.

3.04 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

A. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
      b. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
      c. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
      d. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

B. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
   a. Allowable Leakage, Supply Duct Systems: 1 percent of design airflow.
   b. Allowable Leakage, Return Duct Systems: 2 percent of design airflow.
   c. Allowable Leakage, Exhaust Supply Duct Systems: 2 percent of design airflow.
   d. Allowable Leakage, Supply Duct Systems, Terminals to Air Outlets: 2 percent of design airflow.
4. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
5. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.07 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

C. Use service openings, as required, for physical and mechanical entry and for inspection.
   1. Create other openings to comply with duct standards.
   2. Disconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling sections to gain access during the cleaning process.

D. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

E. Clean the following metal duct systems by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.

F. Mechanical Cleaning Methodology:
   1. Seal air duct at fabrication shop for delivery and storage. Seal open ends after installation. No debris shall enter duct. Construction Manager shall be responsible for verifying and enforcing this method.

G. Cleanliness Verification:
   1. Visually inspect metal ducts for contaminants.
   2. Where contaminants are discovered, re-clean and reinspect ducts.

H. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Duct access doors.

C. Duct test holes.

D. Fire dampers.

E. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 3100 - HVAC Ducts and Casings.

E. Section 26 2717 - EQUIPMENT WIRING: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

B. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

E. Project Record Drawings: Record actual locations of access doors and test holes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.03 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.04 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

D. Fusible Links: UL 33, separate at 165 degrees F.

2.05 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Nailor Industries Inc; Model 1090 round damper with HL2 quadrant option: www.nailor.com.
   2. Ruskin Company; Model CDRS25 round damper and CD60 rectangular damper: www.ruskin.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Blast Gates:
   1. Suitable construction for operation against 8 inches H2O differential pressure.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
   1. Fabricate for duct sizes up to 6 x 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Demonstrate re-setting of fire dampers to Owner's representative.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 22 0548.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

I. Utilize blast gates as first manual volume damper at all duct branch connections to high pressure cold deck and return duct mains. Elsewhere utilize other damper models specified.

J. Use splitter dampers only where indicated.

K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

D. Section 26 2717 - EQUIPMENT WIRING: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

B. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2007.

G. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck; Model SP-A: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. Twin City Fan; Model _____: www.twincityfan.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 CABINET AND CEILING EXHAUST FANS

A. Performance Ratings:
   1. Air Flow: 1000 cfm.
   2. Static Pressure: 0.5 inches wg.
   3. Electrical Characteristics:
      a. 120 volts, single phase, 60 Hz.
      b. 7.8 amperes maximum fuse size.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Registers/grilles.

B. Louvers.

1.02 RELATED REQUIREMENTS

A. Section 23 41 00 - Air Filters

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006 (R2011).

C. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nailor Industries Inc..

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERS

A. Type: 6 inch deep with drainable blades on 35 degree slope , heavy channel frame, 5/8"x0.40" inch aluminum mesh screen over exhaust and 5/8"x0.40" inch aluminum mesh screen over intake.

B. Fabrication: 6063T6 extruded aluminum with 0.125" wall thickness. Louver to have Kynar finish.

C. Color: To be selected by Architect from manufacturer's full range.

D. Mounting: Furnish with interior flat flange for installation.

2.03 DUCT MOUNTED SUPPLY GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.

B. Filter: Filter clips capable of accommodating 2" deep filter.

C. Grille Attachement: Grill is attached to frame with full lenght piano hinge.

D. Material: Formed Aluminum.

E. Finish: Electrocoat acrylic baked enamel.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 23 4100
AIR FILTERS

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 SUMMARY

A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.03 SUBMITTALS

A. Product Data: Include dimensions; shipping, installed, and operating weights; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.
   1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
   2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.

C. Maintenance Data: For each type of filter and rack to include in maintenance manuals specified in Division 1.

1.04 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Other manufacturers systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Comply with NFPA 90A and NFPA 90B.

C. ASHRAE Compliance: Comply with provisions of ASHRAE 52.1 and 52.2 for method of testing and rating air-filter units.

D. Comply with NFPA 70 for installing electrical components.

1.05 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide one complete set of filters for each filter bank. If system includes prefilters, provide one sets of prefilters.

PART 2 PRODUCTS

2.01 FACTORY ASSEMBLED CARTRIDGE TYPE PREFILTER

A. Filter will be fabricated from a series of reinforced non-woven fabric filtration media pockets that have been treated with a non flammable odorless filter adhesive. The ends of the pockets shall be bonded by the manufacturer, and the entire filter cartridge shall be flame proofed and listed by the Underwriter's Laboratories as Class 2.
   1. Arrestance (ASHRAE 52.1): 90.

2. MERV (ASHRAE 52.2): 8.

B. Filter housing shall be fabricated from 16 gauge galvanized steel composed of one or more modules for field assembly. Access doors on each housing end, flanges for attachment to ductwork, prefilter rack and gasketed final filter rack shall be provided for final assembly into a complete unit. Access doors shall be gasketed around perimeter and for compression against filter cells to prevent leakage.

C. All access doors shall be hinged and held closed by spring catches

D. Provide positive filter locking mechanism using force to seal perimeter gasketing around each filter.

2.02 DISPOSABLE PLEATED AIR FILTERS

A. Disposable pleated filter, cotton polyester media with wire back-ing. Filter bonded to heavy paperboard or internal metal frame on front, back and sides. Average filter efficiency of 25-30% as measured by ASHRAE 52-76. Provide permanent holding frame of sizes scheduled on drawings. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   1. Arrestance (ASHRAE 52.1): 90.
   2. MERV (ASHRAE 52.2): 8.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install a MERV 8 filter in the outdoor air ductwork after the control damper and before the supply grille.

B. Install filter frames according to manufacturer's written instructions.

C. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

D. Install filters in position to prevent passage of unfiltered air.

E. Install filter gage for each filter bank.

F. Install filter gage static-pressure tips upstream and downstream from filters to measure pressure drop through filter. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

G. Coordinate filter installations with duct and air-handling unit installations.

H. Electrical wiring and connections are specified in Division 26 Sections.

I. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components, filter and filter-frame installation, and electrical wiring. Report results in writing.

B. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg or to designed operating pressure, whichever is higher; and test housing joints, door seals, and sealing edges of filter for air leaks according to ASME N510 pressure-decay method.

3.03 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay items 230500.11.

END OF SECTION

SECTION 23 8129

VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Air-cooled/Condensing unit(s).
   2. Indoor/Evaporator units.
   3. Refrigerant piping.
   4. Control panels.
   5. Control wiring.

1.02 SYSTEM DESCRIPTION

A. Variable capacity, split system heat pump heat recovery air conditioning system. The system shall be capable of cooling or heating. The system shall consist of an outdoor unit with variable flow compressors, an indoor unit, and Direct Digital Controls capable of interfacing with the building automation system.

B. A variable capacity, heat pump air conditioning variable refrigerant volume type split system. The system shall consist of one evaporator using PID control, connected to a single condenser unit. The condenser shall be a direct expansion (DX), air-cooled, heat pump split air-conditioning system, with inverter driven variable speed compressor(s), using R-410A refrigerant. The condenser shall be a unified heat pump system or a unified heat pump system to allow for future system reconfiguration.

C. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation.
   1. The indoor unit shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

1.03 RELATED REQUIREMENTS

A. Section 01 7900 - Demonstration and Training.

B. Section 01 9113 - General Commissioning Requirements.

C. Section 01 9114 - Commissioning Authority Responsibilities.

D. Section 23 0800 - Commissioning of HVAC.

E. Section 23 2300 - Refrigerant Piping and Specialties: Additional requirements for refrigerant piping system.

F. Section 26 2717 - Equipment Wiring: Power connections to equipment.

1.04 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.

C. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

D. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc; 2013, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.

C. Design Data:
   1. Provide design calculations showing that system will achieve performance specified.
   2. Provide design data required by ASHRAE 90.1.

D. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings shown in the contract documents:
   1. Air Cooled Units:
      a. Refrigerant Type and Size of Charge.
      b. Cooling Capacity: Btu/h.
      c. Heating Capacity: Btu/h.
      d. Cooling Input Power: Btu/h.
      e. Heating Input Power: Btu/h.
      f. Operating Temperature Range, Cooling and Heating.
      g. Air Flow: Cubic feet per minute.
      h. Fan Curves.
      i. External Static Pressure (ESP): Inches WG.
      j. Sound Pressure Level: dB(A).
      k. Electrical Data:
         1) Maximum Circuit Amps (MCA).
         2) Maximum Fuse Amps (MFA).
         3) Maximum Starting Current (MSC).
         4) Full Load Amps (FLA).
         5) Total Over Current Amps (TOCA).
         6) Fan Motor: HP.
      l. Weight and Dimensions.
      m. Maximum number of indoor units that can be served.
      n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.
      o. Maximum height difference between water cooled unit to indoor/evaporator unit, both above and below.
      p. Control Options.
   2. Indoor/Evaporator Units:
      a. Cooling Capacity: Btu/h.
      b. Heating Capacity: Btu/h.
      c. Cooling Input Power: Btu/h.
      d. Heating Input Power: Btu/h.
      e. Air Flow: Cubic feet per minute.
      f. Fan Curves.
      g. External Static Pressure (ESP): Inches WG.
      h. Sound Pressure level: dB(A).
      i. Electrical Data:
         1) Maximum Circuit Amps (MCA).
         2) Maximum Fuse Amps (MFA).
         3) Maximum Starting Current (MSC).
         4) Full Load Amps (FLA).
         5) Total Over Current Amps (TOCA).
         6) Fan Motor: HP.
      j. Maximum Lift of Built-in Condensate Pump.

k. Weight and Dimensions.
l. Control Options.

3. Control Panels: Complete description of options, control points, zones/groups.

E. Specimen Warranty: Copy of manufacturer's warranties.

F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

G. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
1. Detailed piping diagrams, with branch balancing devices.
2. Condensate piping routing, size, and pump connections.
3. Detailed power wiring diagrams.
4. Detailed control wiring diagrams.
5. Locations of required access through fixed construction.
6. Drawings required by manufacturer.
7. In addition to paper copies, submit shop drawings as CAD files in DXF format.
8. Architect will furnish CAD files for use in preparing shop drawings.

H. Operating and Maintenance Data:
1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
3. Identification of replaceable parts and local source of supply.

I. Project Record Documents: Record the following:
1. As-installed routing of refrigerant piping and condensate piping.
2. Locations of access panels.
3. Locations of control panels.

J. Warranty: Executed warranty, made out in Owner's name.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 20 years.

B. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

E. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. The units shall be covered by the manufacturer’s limited warranty for a period of five (5) years from date of installation.

C. Compressors: Provide manufacturer's warranty for seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or

material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty shall include labor.

1.09 COORDINATION

A. Coordination between the controls contractor and the vendor/supplier is required to ensure VRF system interfaces with the DDC system properly. Vendor/supplier shall provide technical support as necessary to aid the controls contractor in interconnecting the DDC and VRF systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The system design shown in the contract documents is based on equipment and system designed as indiecated in the mechanical equipment schedules drawings.

B. Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
   1. Substitution requests will be considered only if received at least 10 days prior to the bid date.
   2. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   3. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   4. Contractor or HVAC subcontractor shall certify that the substitute system will achieve the performance specified.
   5. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.02 HVAC SYSTEM DESIGN

A. Commercial Unit System Operation: Heating or cooling, selected at system level.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
      a. Exception: Where indicated, multiple indoor/evaporator units may be controlled in groups.
   2. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   3. Conditioned spaces are shown on the drawings.
   4. Outdoor/Condenser unit locations are shown on the drawings
   5. Indoor/Evaporator unit locations are shown on the drawings.
   6. Branch selector unit locations are shown on the drawings.

B. Cooling Mode Interior Performance:
   1. Daytime Setpoint: 82 degrees F, plus or minus 3 degrees F.
   2. Setpoint Range: 75 degrees F to 82 degrees F.
   3. Night Setback: 82 degrees F.
   4. Interior Relative Humidity: 50 percent, maximum.

C. Heating Mode Interior Performance:
   1. Daytime Setpoint: 55 degrees F, plus or minus 3 degrees F.
   2. Setpoint Range: 55 degrees F to 80 degrees F.
   3. Night Setback: 55 degrees F.
   4. Interior Relative Humidity: 10 percent, minimum.

D. Outside Air Design Conditions:
   1. Summer Outside Air Design Temperature: 0.4 percent cooling design condition listed in ASHRAE Fundamentals Handbook.
   2. Winter Outside Air Design Temperature: 99.6 percent heating design condition listed in ASHRAE Fundamentals Handbook.

E. Energy Design Wind Speed: 25 mph.

F. Operating Temperature Ranges:
   1. Cooling Mode Operating Range: 0 degrees F to 115 degrees F dry bulb.
   2. Heating Mode Operating Range: 0 degrees F to 75 degrees F dry bulb; 0 degrees F to 75 degrees F wet bulb; without low ambient controls or auxiliary heat source.

G. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
   1. Maximum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 541 feet, actual; 541 feet, equivalent without the need for line size change or traps.
   2. Total Combined Liquid Line Length: 1,800 to 2,600 feet, maximum.
   3. Maximum Vertical Distance Between Outdoor/Central Unit(s) and Terminal Units: 164 feet.

H. Controls: Provide the following control interfaces:
   1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.
   2. BACNet gateways sufficient to connect all units to building automation system by others; include wiring to gateways.
   3. Building automation system by HVAC system manufacturer ; provide one user stations located where directed.

I. Local Controllers: Wall-mounted, wired, containing temperature sensor.

J. Remote Temperature Sensors: In addition to temperature sensors integral with indoor/evaporator units, provide wall-mounted, wired remote temperature sensors located in the same room for the following:
   1. Wall mounted units mounted up high.
   2. Exception: Where a local controller with temperature sensor is provided for the particular unit and is located in the same space.

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
   1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
   2. Refrigerant: R-410A.
   3. Performance Certification: AHRI Certified; www.ahrinet.org.
   4. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL and bearing the certification label.
   5. Provide outdoor condensing units capable of serving indoor unit capacity ranging from 50% to 150% of outdoor rated capacity.
   6. Provide units capable of serving the zones indicated.
   7. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
      a. Inlet water temperaure range of 25 degrees F to 110 degrees F.
   8. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.
   9. Outdoor Units: Units and their supports designed and installed to resist wind pressures defined in ASCE 7.

B. Electrical Characteristics:
   1. Power - Condensing Units: 208 to 230 Volts, single phase, 60 Hz.
   2. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
   3. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
   4. 208-230 Voltage Range: 187 to 253 volts.

C. System Controls:

1. Include self diagnostic, auto-check functions to detect malfunctions and display the type and location.

D. Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.
   1. Provide interfaces to remote control and building automation systems as specified.

E. Wiring:
   1. Control Wiring: 18 AWG, 2-conductor, non-shielded, non-polarized, stranded cable.
   2. Control Wiring Configuration: Daisy chain.

F. Refrigerant Piping:
   1. Provide three-pipe refrigerant system, including high/low pressure dedicated hot gas, liquid and suction lines; two-pipe systems utilizing lower temperature mixed liquid/gas refrigerant to perform heat recovery are not permitted due to reduced heating capabilities.
   2. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.
   3. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 REFRIGERANT

A. Refrigerant: R410A refrigerant shall be required for outdoor unit systems.

B. Oil: Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

2.05 CONDENSING UNITS

A. Condensing Units: Air-cooled refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Inverter-driven, scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.
   3. The unit shall have an accumulator with refrigerant level sensors and controls.
   4. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
   5. Capable of being installed with wiring and piping to the left, right, rear or bottom.
   6. Capable of heating and cooling operation at inlet water operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
   7. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
   8. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation.
   9. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
   10. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

11. The water cooled unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
12. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to indoor units.
13. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
14. Oil Separator: Unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
15. Defrost: Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.
16. Controls: Provide contacts for electrical demand shedding.
17. Product:
    a. Daikin RXS Series ("heat pump"); .

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.
   2. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.0 in WG, minimum, but capable of normal operation under a maximum of 0.24 in WG external static pressure via dipswitch.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.
   1. Copper Tube: Hi-X seamless copper tube.
   2. Coil Design: N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
   3. Corrosion Protection: Fins coated with anti-corrosion acrylic resin and hydrophilic film type E1; pipe plates coated with powdered polyester powder coating of 2.0 to 3.0 microns thickness.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 8 percent to 100 percent of total capacity.
   1. Variable Speed Control: Capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure; high/low pressures calculated by samplings of evaporator and condenser temperatures every 20 seconds, with compressor capacity adjusted to eliminate deviation from target value by changing inverter frequency or on/off setting of fixed speed compressors.
      a. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” with a maximum speed of 6,450 rpm.
   2. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.

3. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
4. Inverter Driven Compressors: PVM inverter driven, highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G2-type” with maximum speed of 7,980 rpm.
5. Rotors: Incorporating neodymium magnets for higher torque and efficiency; at complete stop of compressor, position rotor into optimum position for low torque start.
6. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Provide oil separators and intelligent oil management system.
8. Provide spring mounted vibration isolators.

F. Electrical:
1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz)187-228 volts (208V/60Hz) or 414-506V (460V/60Hz).
3. The unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the condensing unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.06 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
   a. Provide thermistor on liquid and gas lines.
4. Fans: Direct-drive, with statically and dynamically balanced impellers; high, mid and low speeds unless otherwise indicated; motor thermally protected.
   a. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
   a. Where high efficiency filters are indicated, provide air filter rack.
6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
   a. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
   b. The units shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4” inches above the condensate pan
   c. Units Without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections.
7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Wall Surface-Mounted Units: Finished white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.
1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
3. Condensate Drain Connection: Back, with piping concealed in wall.
4. Fan: Direct-drive cross-flow type.

5. Products:
   a. Daikin FTXS Series.

2.07 CONTROLS

A. Building Automation System Integration: Provide all the required hardware and software to enable integration with Building Management Systems (BMS) via BACnet® interface.
   1. The HVAC BACnet® interface shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories.
   2. The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

B. Analog Input (AI) Board(s): Provide I/O board(s) capable of monitoring temperature or humidity.
   1. Each AI board shall have two analog inputs. Each input shall be capable of receiving a 4/20mA, 0/10 VDC, or 1/5 VDC signal for monitoring temperature or humidity.
   2. The AI board shall be capable of monitoring the temperature or humidity input and shall be capable of displaying graphical trending of the temperature or humidity values.
   3. The AI board shall be capable of setting the following parameters on the indoor unit On/Off, Mode, and Set Temperature to predefined settings based on the input value of the temperature or humidity. The AI board shall also be capable of interlocking the On/Off state of a digital output on the input value of the temperature or humidity.

C. System shall be provide with a factory supplied wall mounted hard-wired thermostat/humidity sensor. System shall be capable of providing space conditioning as needed to meet set point. DDC system shall have the capabilities of modifying the space set points.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.03 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to inspect installation prior to startup.

3.04 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform system startup.

B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.05 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.06 COMMISSIONING

A. See Section 01 9113 for commissioning requirements.

B. Perform commissioning as specified in Section 23 0800.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.08 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Replace exposed components broken or otherwise damaged beyond repair.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 25 0000

HVAC INSTRUMENTATION AND CONTROLS

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.

B. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.02 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:
   1. Division 26 Section on fire alarm systems.

1.03 DEFINITIONS

A. DDC: Direct-digital controls.

B. LAN: Local area network.

C. MS/TP: Master-slave/token-passing.

D. PICS: Protocol Implementation Conformance Statement.

1.04 REFERENCE STANDARDS

A. A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

1.05 SYSTEM DESCRIPTION

A. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems.

B. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

C. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

D. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

E. Control system includes the following:
   1. Fire alarm system specified in Division 16 Section "Fire Alarm."

1.06 SEQUENCE OF OPERATION

A. As specified in the drawings

1.07 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. Each control device labeled with setting or adjustable range of control.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including leakage and flow characteristics.
7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
8. Listing of connected data points, including connected control unit and input device.
9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C. Samples: For each color required, of each type of thermostat cover.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or monitoring and control revisions.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Perform work in accordance with NFPA 70.

E. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

1.09 DRAWINGS USE AND INTERPRETATION

A. It is not the intention of the drawings to show every item, piece of equipment, and detail related to the project.

B. The drawings are diagrammatical and indicate the general arrangement of systems and equipment, unless indicated otherwise by dimension or Detail Drawings. For exact locations of building elements, refer to dimensioned Architectural/Structural Drawings. However, field measurements take precedence over dimensioned drawings. The installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawing requirements specified in Division 1 – General Requirements, and the General Conditions.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.11 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 16 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

D. Coordinate equipment with Division 16 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

E. Coordinate equipment with Division 16 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

F. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

G. DDC system shall interconnect with Split-System heat pump. See the controls drawings for the points to be mapped to the DDC system. Coordinate with heat pump vendor to ensure full understanding of what is required to interconnect the two systems is understood and provided for.

1.12 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

B. Require attendance of parties directly affecting the work of this Section.

1.13 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Replacement Materials: One replacement diaphragm or relay mechanism for each unique controller, thermostat, and positioning relay.

1.14 MAINTENANCE SERVICE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections per year, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

1.15 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
   1. Limiting use of software to equipment provided under these specifications.
   2. Limiting copying.
   3. Preserving confidentiality.
   4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 PROVIDER

A. Provider: Subject to compliance with requirements, HVAC Instrumentation and Controls provider shall be one of the firms from the pre-qualified list below:
   1. Vermont Control Systems, LLC, Paul Lekstutis, (802) 233-0991
   2. Alliance Mechanical, Erik Packer, (802) 864-4000
   3. Temperature Controls of Vermont, Matt Williams, (802) 872-8000
   4. Siemens Building Technologies, Inc., Mark Durant, (518) 222-3415

2.02 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each input/output point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator station.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse input/output.
      c. Monitoring, controlling, or addressing data points.
      d. Testing and developing control algorithms without disrupting field hardware and controlled environment.
      e. WEB Based.
      f. BACNET Compatible
   3. Local operator interface provides for download from or upload to mobile operator station.
   4. Controller to controller communications “bus” shall not operate at speeds below 156kbps.
   5. Controllers shall have the ability to retain commissioning notes in non-volatile memory.
   6. Controllers shall retain their own schedules and set points in non-volatile on board memory, and shall not look to, poll, or be polled by any global controller to accomplish said functionality.
   7. Controller shall have the ability to put analog and digital outputs into “hand-auto-off” mode and monitor the status of said switches for alarming purposes and graphical display.
   8. Controllers shall have built-in 24 VDC power supplies.
   9. All controllers shall have published PICS BACNET conformance.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each input/output point; process information; and download from or upload to operator station.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse input/output.
      c. Monitoring, controlling, or addressing data points.
      d. WEB Based.
      e. BACNET Compatible
   3. Local operator interface provides for download from or upload to mobile operator station.
   4. Controller to controller communications “bus” shall not operate at speeds below 156kbps.
   5. Controllers shall have the ability to retain commissioning notes in non-volatile memory.
   6. Controllers shall retain their own schedules and set points in non-volatile on board memory, and shall not look to, poll, or be polled by any global controller to accomplish said functionality.

7. Controller shall have the ability to put analog and digital outputs into “hand-auto-off” mode and monitor the status of said switches for alarming purposes and graphical display.
8. Controllers shall have built-in 24 VDC power supplies.
9. All controllers shall have published PICS BACNET conformance.

C. LAN Gate: Shall establish seamless interconnection between other electrical and mechanical subsystems. Shall provide communications between local control units and the graphical user interface.

D. System Work Station: Provide a local work station with monitor for operator interface. Monitor shall be flat screen, minimum 20”, 1920 x 1080 resolution, CPU to be 3.0 Giga hertz operating speed, minimum 8 GB RAM with all required drivers and network cards required. Hard drive shall be 7,200 RPM with a minimum 750 GB for storage of data and trending. Provide with operating system and all required software with licenses.
   1. Work station location shall be coordinated with owner (may be located off site).

E. System Software: Provide latest version of all software at Project completion. Include site licenses for all software. Include and implement the following capabilities from the control units:
   1. Units of Measure: Inch-pound and SI.
   2. WEB Based. The building system interface shall be capable of being accessed via a web based interface.

F. Site Development Tools: Provide all site development tools including graphics and logic programming software. Include site licenses for all software.

2.03 CONTROL PANELS

A. Central (Master) Control Panels: Fully enclosed, steel-rack-type cabinet with locking doors or locking removable backs. Match finish of panels and provide multicolor graphic displays, schematically showing system being controlled.

B. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
   1. Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
   2. Panel-Mounted Equipment: Temperature and humidity controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
   3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
   4. Graphics: Color-coded graphic, laminated-plastic displays on doors, schematically showing system being controlled, with protective, clear plastic sheet bonded to entire door.

C. Alarm Panels: Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted in hinged-cover enclosure.
   1. Alarm Condition: Indicating light flashes and horn sounds.
   2. Acknowledge Switch: Horn is silent and indicating light is steady.
   3. Second Alarm: Horn sounds and indicating light is steady.
   4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
   5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.04 SENSORS

A. Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
   1. Thermistor temperature sensors as follows:
      a. Accuracy: Plus or minus 0.36 deg F at calibration point.
      b. Wire: Twisted, shielded-pair cable.
   2. Resistance Temperature Detectors: Platinum.
      a. Accuracy: Plus or minus 0.2 percent at calibration point.

b. Wire: Twisted, shielded-pair cable.
c. Room Sensors: Match room thermostats, locking cover.
d. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

3. Humidity Sensors: Bulk polymer sensor element.
   a. Accuracy: 5 percent full range with linear output.
   b. Room Sensors: With locking cover matching room thermostats, span of 25 to 90 percent relative humidity.
   c. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
4. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0 to 0.25 inch wg.
   d. Duct Static-Pressure Range: 0 to 5 inches wg.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

B. Equipment operation sensors as follows:
   1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
   2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
   3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

C. Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

D. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vaporproof type.

E. Refrigerant Detectors: Dual-level detectors, using solid-state sensors, with alarm preset for 300 ppm, alarm indicator light, alarm silence light and button, alarm test light and button, and trouble light. Provide auxiliary relay preset for 150 ppm.

F. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment, for flush mounting.

2.05 THERMOSTATS

A. Room Thermostats: Electronic, microcomputer-based room thermostat with digital readout.
   1. 10K ohm thermistor w/ 0.36°F standard accuracy and 0.18°F drift over a ten year space.
   2. Concealed communications port for laptop access.
   3. Multiple units can be daisy chained to one controller.
   4. LCD display capable of indicating zone temperature, heating set point, cooling set point and outdoor air temperature.
   5. Occupancy override switch with adjustable override time.
      a. Display indicates override time when activated.
      b. Override time rate and maximum override time shall be fully programmable.
   6. Mounting: Standard 2x4 box.

B. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.
   1. Bulbs in water lines with separate wells of same material as bulb.
   2. Bulbs in air ducts with flanges and shields.
   3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.

4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument

C. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

D. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable set point in middle of range and adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

E. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

F. Electric High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

G. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.06 HUMIDISTATS

A. Duct-Mounted Humidistats: Electric insertion, 2-position type with adjustable 2 percent throttling range, 20 to 80 percent operating range, single- or double-pole contacts.

B. Room Humidistats:
1. Wall mounted, proportioning type.
2. Throttling range: Adjustable 2 percent relative humidity.
3. Operating range: 30 to 80 percent.
4. Maximum temperature: 110 degrees F.
5. Cover: Set point indication.

2.07 INPUT/OUTPUT SENSORS

A. Temperature Sensors:

B. Humidity Sensors:
1. Elements: Accurate within 5 percent full range with linear output.
2. Room Sensors: With locking cover matching pneumatic thermostats used, span of 10 to 60 percent relative humidity.
3. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 - 100 percent relative humidity.

C. Static Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 - 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation Sensors:
1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.

2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Digital to Pneumatic Transducers:
1. Convert plus or minus 12 vdc pulse width modulation outputs to 0 to 20 psi.

F. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

G. Carbon Monoxide Detectors:
1. Single or multichannel dual level detectors, using solid state sensors with three year minimum life. Sensor replacement shall take maximum 15 minutes. Suitable over temperature range of 23 to 130 degrees F.
2. Provide individual indicators and contractors for each level, initially calibrated for 50 ppm and 100 ppm.
3. Maximum response time to 100 ppm CO calibration gas: Two minutes.

2.08 TRANSMITTERS

A. Differential Pressure Transmitters:
1. Two pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

B. Pressure Transmitters:
1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

C. Temperature Transmitters:
1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degree F span and plus or minus 1 percent for 50 degree F span, with 50 degrees F temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

D. Humidity Transmitters:
1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.09 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
3. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Damper and Large-Valve Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Valves: Size for torque required for valve close-off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:

a. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. of damper.
3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
6. Power Requirements Two-Position Spring Return: 120-V ac.
7. Temperature Rating: Minus 22 to plus 122 deg F.
8. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
9. Run Time: 12 seconds open, 5 seconds closed.

2.10 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Globe Valves NPS 2 and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

C. Globe Valves NPS 2-1/2 and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

D. Hydronic system globe valves shall have the following characteristics:
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
3. Sizing: 3-psig maximum pressure drop at design flow rate.
4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.

E. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable Buna N sleeve and stem seals.
1. Body Style: Wafer.
2. Disc Type: 316 Stainless Steel.
3. Sizing: 1-psig maximum pressure drop at design flow rate.

F. Terminal Unit Control Valves: Bronze body, bronze trim, two- or three-port as indicated, replaceable plugs and seats, union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.11 DAMPERS

A. Refer to schedule on drawing M3.01 for responsibilities for furnishing and installing dampers and damper actuators.

B. Refer to damper schedules on drawing M5.04 for required control damper types.

C. Dampers: AMCA-rated, opposed blade design; 0.1084-inch minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 0.0635-inch galvanized steel with maximum blade width of 8 inches.
1. Blades shall be secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. For standard applications, include optional closed-cell neoprene edging.

4. For low-leakage applications, use opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

PART 3 EXECUTION

3.01 ARANGEMENT OF WORK

A. Install work as closely as possible to layouts shown on contract drawings. Modify work as necessary to provide maximum possible headroom and space clearance on each side. Provide adequate clearance and ready access to all parts of the work, for inspection operation, safe maintenance and repair, and code conformance. Coordinate and arrange work to avoid conflicts with other trades and as needed for satisfactory space conditions shown on coordination drawing submittals. Where space appears to be inadequate consult Design Professional before proceeding with installation.

3.02 COORDINATION

A. Examine Contract Documents and coordinate with contractor and other trades as necessary to facilitate the progress of work.

B. Furnish services of experienced electrical superintendent who shall be constantly in charge of electrical work, together with skilled laborers required to unload, transfere, erect, connect, adjust, start, operate, and test each system.

C. Do not install a system until critical components of systems and related systems have been coordinated and applicable shop drawings have been approved.

D. DDC system shall interconnect with Split-System heat pump. See the controls drawings for the points to be mapped to the DDC system. Coordinate with heat pump vendor to ensure full understanding of what is required to interconnect the two systems is understood and provided for.

3.03 PROTECTION

A. The Controls Contractor shall be responsible for work and equipment until fully inspected, tested and accepted. Carefully store materials and equipment, which is not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material or damaging water.

3.04 LUBRICATION

A. Equipment shall be furnished and installed so that lubrication points are conveniently and readily accessible for maintenance. Make these provisions by whatever means is appropriate: extended fittings, access doors, equipment location, etc. Provide lube sites for grease fittings.

3.05 TESTING AND BALANCING

A. Provide controls systems operations during the mechanical systems adjustment period at the completion of each phase of the project, and during the final testing and balancing procedures. Document all issues encountered during the mechanical systems adjustment period. Submit three copies of issues to Owner's Construction Supervisor.

3.06 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

3.07 INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve sequence of operation specified.

D. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Coordinate location with owner.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

E. Install guards on thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Where indicated.

F. Install automatic dampers according to Division 15 Section "Duct Accessories."

G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."

I. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."

J. Install steam and condensate instrument wells, valves, and other accessories according to Division 15 Section "Steam and Condensate Piping."

K. Install refrigerant instrument wells, valves, and other accessories according to Division 15 Section "Refrigerant Piping."

L. Install duct volume-control dampers according to Division 15 Sections specifying air ducts.

3.08 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Controls Contractor is responsible for all controls wiring and conduit.

B. All controls conductors shall be installed in conduit.
   1. Minimum conduit size shall be ½” EMT.

C. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."

D. Install building wire and cable according to Division 16 Section "Conductors and Cables."
   1. Install controls conductors in minimum ½” EMT
   2. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

E. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

F. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.09 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
   1. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
4. Pressure test control air piping at 30 psig or 1.5 times the operating pressure for 24 hours, with maximum 5-psig loss.
5. Pressure test high-pressure control air piping at 150 psig and low-pressure control air piping at 30 psig for 2 hours, with maximum 1-psig loss.
6. Calibration test pneumatic and electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

C. Verify DDC as follows:
1. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
2. Verify operation of operator workstation.
3. Verify local control units including self-diagnostics.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 40 hours' dedicated instructor time on-site.
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.12 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

PART 4 MEASUREMENTS & PAYMENTS

4.01 MEASUREMENT

A. Incidental to Elevator Machine Room Mechanical and Plumbing Scope.

4.02 PAYMENT

A. Incidental to pay item 230500.11.

END OF SECTION

SECTION 260500

BASIC ELECTRICAL MATERIALS AND METHODS

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 SUMMARY

A. This Section includes the following:

1. Supporting devices for electrical components.
2. Cutting and patching for electrical construction.
3. Touchup painting.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.04 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

D. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

1.05 SUBMITTALS

A. Product Data: For each miscellaneous item indicated. Include data on features, accessories, and installation requirements as required:

1. Data cable and termination hardware.
2. Elevator disconnect replacement.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Refer to Section 260533.

2.02 CONDUCTORS

A. Refer to Section 261519

2.03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

C. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least one surface.

1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Toggle Bolts: All-steel springhead type.

F. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.05 DATA CABLE

A. Provide CAT6 data cable for new data network drop as shown on plans. Cable shall match existing system network cabling for make.

B. Provide all termination jacks and connections required to integrate new data drop into existing network system. Coordinate with Marketplace coordinator for patch panel location and cable labeling required to match existing system convention.

2.06 DISCONNECT

A. Provide disconnects with ampere rating, features, and NEMA construction type as shown on plan.

B. Provide all terminations and connection hardware required to integrate with newly renovated elevator system.

2.07 DEMOLITION

A. Demolition work, which falls under the responsibility of the electrical contractor, shall include work as outlined under this specification section as well as specific and general notes shown on electrical drawings.

B. Demolition work that falls under this contract includes demolition work regarding areas within existing building that includes removal of existing designated electrical power and lighting, and associated cabling and raceway systems; and also includes work that will be renovated but required some degree of demolition or replacement of existing cabling, devices, or fittings to accomplish these goals. Demolition work also includes portions of the existing building abandoned electrical circuiting that shall be completely demolished and associated refuse removed from site.

C. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

2.08 BEAM ENVELOPE ACCOMMODATION

A. Contractor shall be required to support existing surface run conduits and circuiting that are run along the surface of beams that are being modified to minimize additional decay due to water infiltration. Refer to the entire plans set and associated details for anticipated remediation work and provide independent means of support for electrical circuiting affected.

2.09 NEW CONTROL RELAY

A. As part of Mechanical system work, a new 120 volt control relay will be needed to control power to renovated elevator machine room unit heater. See plans for details. Coil low voltage of relay shall match mechanical control system requirements.

2.10 NEW HVAC CONNECTIONS

A. Electrical contractor shall provide power circuiting and terminations to HVAC equipment as shown on plans. Existing power circuits can be reused for replacement HVAC units; however, contractor shall confirm that circuit requirements for new equipment can be adequately served from existing circuits in place.

2.11 ELEVATOR CONNECTIONS

A. The elevator motors are to be replaced as part of elevator renovation work. Electrical contractor shall provide for the disconnection of existing elevator motors and reconnection of new motors once installed. Control panel may also require removal and reconnection of existing 120 volt circuit. Electrical contractor shall provide for a complete reuse and re-installation of existing power circuit for elevator equipment as required for a complete renovation fit-up.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION

A. Refer to Section 260533

3.03 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Selection of Supports: Comply with manufacturer's written instructions.

D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.04 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving

lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.05 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.06 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.07 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.
8. Modifications to existing systems due to impact of demolition or renovation work.

3.08 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.09 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

4.01 MEASUREMENT

A. The miscellaneous quantities of support hardware in the installation of other system products will be measured for payment with the specific product requiring these hardware items.

4.02 PAYMENT

A. The accepted quantity of data cabling including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per fixture.

Pay Item	Pay Unit
260500.11	Linear foot

B. The accepted quantity of disconnects including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.12	Each

C. The accepted quantity of demolition work including full compensation for removal and disposal of all cited materials, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.13 (Marketplace)	Lump sum
260500.23 (College St)	Lump sum

D. The accepted quantity of beam envelope accommodation, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.14	Each

E. The accepted quantity of installing new control relay including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.15	Each

F. The accepted quantity of installing new HVAC connections including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.16	Each

G. The accepted quantity of elevator circuit reconnections including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per unit.

Pay Item	Pay Unit
260500.17	Each

END OF SECTION

SECTION 260526

GROUNDING AND BONDING

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 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.
b. Chance/Hubbell.
c. Erico Inc.; Electrical Products Group.
d. Framatome Connectors/Burndy Electrical.
e. Ideal Industries, Inc.
f. ILSCO.

g. Kearney/Cooper Power Systems.
h. Korns: C. C. Korns Co.; Division of Robroy Industries.
i. O-Z/Gedney Co.; a business of the EGS Electrical Group.
j. Raco, Inc.; Division of Hubbell.
k. Thomas & Betts, Electrical.

2.02 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

E. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

PART 3 - EXECUTION

3.01 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Flexible raceway runs.
5. Metal-clad cable runs.
6. Motor and appliance branch circuits.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

C. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, heater units, and dampers. Use braided-type bonding straps.

3.04 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

B. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

C. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A UL 486B.

E. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

4.01 MEASUREMENT

A. The quantity of grounding conductors will be measured for payment along with measurements derived for conductors and cables.

4.02 PAYMENT

A. Incidental to other pay items. Reference Specifications section 281519.

END OF SECTION

SECTION 260533

RACEWAYS AND BOXES

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 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:
    a. ENT.
    b. RNT
    c. LFNC

2. Boxes, enclosures, and cabinets include the following:

    a. Device boxes.
    b. Outlet boxes.
    c. Pull and junction boxes.

B. Related Sections include the following:

1. Division 7 Section "Firestopping."
2. Division 26 Section "Basic Electrical Materials and Methods" for raceways and box supports.
3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.03 DEFINITIONS

A. ENT: Electrical nonmetallic tubing.

B. RNC: Rigid nonmetallic conduit.

C. LFNC: Liquid-tight flexible nonmetallic conduit

1.04 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

1.05 SUBMITTALS

A. Product Data: For each item indicated. Include data on features, accessories, and installation requirements as required.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Conduit and Tubing:

    a. Alflex Corp.
    b. Anamet, Inc.; Anaconda Metal Hose.
    c. Anixter Brothers, Inc.
    d. Carol Cable Co., Inc.
    e. Cole-Flex Corp.
    f. Electri-Flex Co.
    g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    h. Grinnell Co.; Allied Tube and Conduit Div.
    i. Monogram Co.; AFC.
    j. Spiraduct, Inc.
    k. Triangle PWC, Inc.
    l. Wheatland Tube Co.

2. Conduit Bodies and Fittings:

    a. American Electric; Construction Materials Group.
    b. Hubbell, Inc.; Killark Electric Manufacturing Co.
    c. Lamson & Sessions; Carlon Electrical Products.
    d. O-Z/Gedney; Unit of General Signal.
    e. Scott Fetzer Co.; Adalet-PLM.
    f. Spring City Electrical Manufacturing Co.

3. Boxes, Enclosures, and Cabinets:

    a. American Electric; FL Industries.
    b. Butler Manufacturing Co.; Walker Division.
    c. Crouse-Hinds; Div. of Cooper Industries.
    d. Electric Panelboard Co., Inc.
    e. Erickson Electrical Equipment Co.
    f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
    g. Hubbell Inc.; Killark Electric Manufacturing Co.
    h. Hubbell Inc.; Raco, Inc.
    i. Lamson & Sessions; Carlon Electrical Products.
    j. O-Z/Gedney; Unit of General Signal.
    k. Parker Electrical Manufacturing Co.
    l. Robroy Industries, Inc.; Electrical Division.
    m. Spring City Electrical Manufacturing Co.
    n. Thomas & Betts Corp.
    o. RACO

2.02 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

C. ENT and RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

D. LFNC: UL 1660.

2.03 OUTLET AND DEVICE BOXES

A. Nonmetallic Boxes: NEMA OS 2.

2.04 PULL AND JUNCTION BOXES

A. Nonmetallic Boxes: NEMA OS 2.

2.05 PAINTING

A. Provide an oil based paint, with suspended galvanized metallic filings designed to provide a degree of resistance to further water infiltration of the painted conduit system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

A. Indoors: Use the following wiring methods:

1. Exposed: ENT or Sealtite (only in non-finished areas and for connections to equipment or light fixtures).
2. Concealed: ENT or Sealtite cable assembly for branch wiring.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Sealtite.
4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
    b. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.

B. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel .
2. Underground, Single Run: RNC.
3. Underground, Grouped: RNC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

3.03 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Conceal conduit, ENT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

N. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

O. Tighten set screws of threadless fittings with suitable tools.

P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

S. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.05 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.06 PAINTING

A. Prepare all surfaces to be painted by thorough cleaning and drying prior to paint application.

B. Provide two coats of galvanized paint to all conduit sections indicated on plans, including all associated mounting hardware, junction boxes, LB connections, couplings, etc. for a complete paint coating on all materials along conduit path and in support of conduit system.

4.01 MEASUREMENT

A. The quantity of junction boxes will be measured for payment at the Contract unit price per box.

B. The quantity of raceways will be measured for payment at the Contract unit price per linear foot

C. The quantity of painting will be measured for payment at the Contract unit price per linear foot.

D. The quantity of modified floor junction boxes will be measured for payment at the Contract unit price per box.

4.02 PAYMENT

A. The accepted quantity of specified junction boxes including full compensation for mounting, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per box.

Pay Item	Pay Unit
260533.11 (Marketplace)	Each
260533.21 (College St.)	Each

B. The accepted quantity of raceway including full compensation for mounting, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
260533.12 (Marketplace)	Linear Foot
260533.22 (College St.)	Linear Foot

C. The accepted quantity of raceway painting including full compensation for preparation cleaning, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
260533.13	Linear Foot

NOT FOR CONSTRUCTION
THESE CONTRACT DOCUMENTS ARE FOR REFERENCE AND VIEWING ONLY

D. The accepted quantity of specified repair to existing floor junction boxes including full compensation for customized material, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per floor box.

Pay Item	Pay Unit
260533.14	Each

END OF SECTION

SECTION 261519

CONDUCTORS AND CABLES

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 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.05 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wires and Cables:
   a. American Insulated Wire Corp.; Leviton Manufacturing Co.
   b. Clifford Wire Company.
   c. Carol Cable Co., Inc.
   d. Senator Wire & Cable Company.
   e. Southwire Company.

2. Connectors for Wires and Cables:

   a. AMP Incorporated.
   b. General Signal; O-Z/Gedney Unit.
   c. Monogram Co.; AFC.
   d. Square D Co.; Anderson.
   e. 3M Company; Electrical Products Division.

2.02 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

B. Thermoplastic Insulation Material: Comply with NEMA WC 5.

C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.

D. Conductor Material: Copper in general; however, large feeders may be aluminum, but only as indicated for specific circuits as shown on plans.

E. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

F. Waterproof Metal Clad cable assembly (Sealtite cable): Sealtite cable use may be permitted for branch circuit wiring in concealed spaces, or exposed in non-finished spaces, for short connections to light fixtures, or to get around difficult concrete constructions.

2.03 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine raceways and building finishes receiving wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRE AND INSULATION APPLICATIONS

A. Branch Circuits: Type THHN/THWN, in raceway, or sealtite.

B. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable.

3.03 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."

3.04 CONNECTIONS

A. Conductor Splices: Cables shall not be spliced.

B. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

C. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

4.01 MEASUREMENT

A. The quantity of conductors and cables will be measured for payment at the Contract unit price per linear foot.

4.02 PAYMENT

A. The accepted quantity of conductors including full compensation for terminations, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot.

Pay Item	Pay Unit
261519.11 (MarketPlace)	Linear Foot
261519.22 (College Street)	Linear Foot

END OF SECTION

SECTION 262726

WIRING DEVICES

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 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.03 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.04 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Samples: For devices and device plates for color selection and evaluation of technical features.

D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.06 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices:

a. Arrow Hart, Inc.
b. Bryant Electric, Inc.
c. Hubbell, Inc.; Wiring Devices Div.
d. Leviton Manufacturing Co., Inc.
e. Pass & Seymour/Legrand; Wiring Devices Div.

2.02 RECEPTACLES

A. Straight-Blade Receptacles: Commercial grade, duplex, 20 amp minimum or as noted on drawings, #5262 series.

B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle, 20 amp rated, commercial grade, arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

C. Special Equipment Outlets: Special purpose receptacles shall be specification grade with back and side wiring.

2.03 SWITCHES

A. Snap Switches: Commercial grade, quiet type, 20A, 120/208VAC. Provide pilot lights for locations as shown on drawings.

2.04 WALL PLATES

A. Single and combination types match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: 0.04-inch- thick, Type 302, stainless steel with painted enamel finish at color determined by owner.
3. Material for Unfinished Spaces: Galvanized steel.

B. Wire: No. 12 AWG.
1. Signal Outlets: Blank insert with bushed cable opening.

2.05 FINISHES

A. Color: Manufacturers standard, white devices with white coverplates.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates. Devices shall be installed so that removal of any one device does not interrupt the continuity of all other devices remaining on the circuit.

D. Protect devices and assemblies during painting.

3.02 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

NOT FOR CONSTRUCTION
THESE CONTRACT DOCUMENTS ARE FOR REFERENCE AND VIEWING ONLY

C. Replace damaged or defective components.

3.04 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

4.01 MEASUREMENT

A. The quantity of wiring devices will be measured for payment at the Contract unit price per device.

4.02 PAYMENT

A. The accepted quantity of receptacles including full compensation for mounting, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per receptacle.

Pay Item	Pay Unit
262726.11	Each

B. The accepted quantity of equipment switches including full compensation for mounting, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per switch.

Pay Item	Pay Unit
262726.12	Each

END OF SECTION

SECTION 265210

LIGHTING

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 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for manual light switches.

1.03 DEFINITIONS

A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.

B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

   1. Dimensions of fixtures.
   2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
   3. Fluorescent ballasts.
   4. LED drivers.
   5. Types of lamps.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

D. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

E. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

F. Samples for Verification: For lighting units or luminaires designated for sample submission in the Exterior Lighting Unit Schedule.

1. Lamps: Specified units installed.
2. Ballast: 120-V model of specified ballast type.
3. Finishes: For each finished metal used in support components.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section, and on project drawings.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.

C. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Comply with NFPA 70.

E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

F. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction

G. Comply with ANSI C2.

H. Comply with NFPA 70.

1.06 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.07 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: For emergency lighting units.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Luminaire Schedule at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Luminaire Schedule at the end of Part 3.

2.02 LUMINAIRES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Housings: Rigidly formed, and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.

F. Exposed Hardware Material: Stainless steel.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.

J. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.

2.03 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. ens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

2.04 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output.
2. Total Harmonic Distortion Rating: Less than 20 percent.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Sound Rating: A.
5. Designed for compatibility with Super T8 lamps and/or as outlined for Efficiency Vermont energy efficiency program accepted standards for incentive qualifications.

B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Certified Ballast Manufacturer Certification: Indicated by label.
2. Encapsulation: Without voids in potting compound.
3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.

C. Fluorescent Dimming Ballasts: Dimming ballasts shall be compatible with associated fixture lamp (linear or compact) and associated dimmer controller (either manual or automatic).

D. Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Power Factor: 90 percent, minimum.
2. Ballast Coil Temperature: 65 deg C, maximum.
3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.05 LAMPS

A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.

2.06 FIXTURE SUPPORT COMPONENTS

A. Jack Chain Hung: Use chain assembly supports recommended by luminaire manufacturer.

2.07 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:
1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.09 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.10 FINISHES

A. Coordinate below with interior lighting fixture schedules or details.

B. Fixtures: Manufacturer's standard, unless otherwise indicated.

Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
Metallic Finish: As indicated on luminaire schedule.

C. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

D. Steel: Grind welds and polish surfaces to a smooth, even finish.

E. Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

B. Install equipment level and plumb and according to manufacturer's written instructions.

C. Mount lighting control devices according to manufacturer's written instructions and requirements in Division 26 Section "Basic Electrical Materials and Methods."

D. Luminaire Attachment: Fasten to indicated structural supports

E. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.

F. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.2 CONNECTIONS

A. Ground equipment. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:
   i. Check intensity and uniformity of illumination.
   ii. Check excessively noisy ballasts.

C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.Delete nonapplicable items below.

D. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

E. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.

F. Verify settings of photoelectric devices with photometer calibrated within previous six months. All interior photoelectric devices shall be field set and adjusted for both daylight and nighttime conditions.

G. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:

   1. Continuity tests of circuits.
   2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

H. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

I. Circuits with fluorescent dimming ballasts and dimmer controls shall be “burned in” for 100 hours of continuous operation at 100% light output level (no dimming) at time of initial installation, prior to any operation utilizing dimming control. Contractor shall issue written statement as part of close out documents that this procedure has been undertaken for all affected circuits.

3.5 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust amiable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

C. Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.6 LUMINAIRE

Fixture Types: Refer to luminaire schedule on drawings.

4.01 MEASUREMENT

A. The quantity of lighting fixtures will be measured for payment at the Contract unit price per fixture.

4.02 PAYMENT

A. The accepted quantity of wall and ceiling light fixtures including full compensation for mounting, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per fixture.

Pay Item	Pay Unit
265210.11	Each

B. The accepted quantity of emergency light fixtures including full compensation for mounting, circuit connections, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per fixture.

Pay Item	Pay Unit
265210.12	Each

C. The accepted quantity of signage lighting provided by City of Burlington, including full compensation for circuit connections, and for furnishing photo-electric control and all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per fixture.

Pay Item	Pay Unit
265210.13 (Marketplace)	Each
265210.23 (College Street)	Each

END OF SECTION

SECTION 321123

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate Base Course to be used under the concrete paving, concrete sidewalks and concrete cast-in-place curbs to be installed around the trench drain repair as shown in the Contract Drawings.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-in-place Concrete.

C. Section 321313 – Concrete Pavement.

D. General Requirements

1.03 REFERENCES

A. AASHTO Standard Specification for Transportation Materials and Methods of Sampling and Testing, 34th Edition

1.04 SUBMITTALS AND CERTIFICATIONS

A. The Contractor shall submit to the Engineer a Certificate of Compliance from the suppliers of aggregate base. The certificates shall indicate that the materials provided are in every way in conformance with the requirements of these Specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. The materials shall consist of hard durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used for aggregate base course materials. Fine particles shall consist of natural or processed sand. The materials shall be free of injurious amounts of organic material and unless otherwise specified, the percent wear of base course materials shall not exceed 40 percent as determined by ASTM C131, Grading A.

B. Crushed stone and crushed ledge rock shall be processed material obtained from a source which has been stripped of all overburden. The processed material shall consist of clean durable fragments of ledge rock of uniform quality reasonably free of thin or elongated pieces.

2.02 GRADATION

A. The required gradation of Sand material shall conform to Table 1. The maximum size of any stone or fragment shall not exceed ¾ of the compacted depth of the layer being placed but in no case larger than 6 inches.

B. The required gradation of Gravel material shall conform to Table 1. The maximum size of stone particles shall not exceed ¾ of the compacted thickness of the layer being placed but in no case larger than 6 inches.

C. The required gradation of Crushed Gravel material shall conform to Table 1. At least 50 percent of the material retained on the 1 inch sieve shall have a fractured face.

D. The required gradation of Modified Crushed Gravel material shall conform to Table 1.

E. At least 50 percent of the material retained on the #4 sieve shall have a fractured face.

F. The required gradation of Crushed Gravel material for shoulders and shoulder leveling shall conform to Table 1:

TABLE 1
BASE COURSE MATERIALS

SIEVE SIZE	**REQUIRED GRADUATION**				**%PASSING BY WEIGHT**		
ITEM	SAND	GRAVEL	CR. GRAVEL	MODIFIED CR. GRAVEL	CR. AGGREGATE FOR SHOULDERS	CR. STONE (FINE)	CR. STONE (COARSE)
6″	100	100	---	---	---	---	---
5″	---	---	---	---	---	---	---
4″	---	---	---	---	---	---	---
3½″	---	---	---	---	---	---	100
3″	---	---	100	100	---	---	85-100
2″	---	---	95-100	95-100	---	100	---
1½″	---	---	---	---	100	85-100	60-90
1″	---	---	55-85	---	90-100	---	---
¾″	---	---	---	---	---	45-75	40-70
#4	70-100	25-70	27-52	27-55	30-65	20-45	15-40
#200 (In Sand Portion)*	0-12	0-12	0-12	0-12	---	---	---
#200 (In Total Sample)	---	---	---	---	0-10	0-5	0-5

** FRACTION PASSING THE NO. 4 SIEVE*

G. The required gradation of Crushed Gravel material for unpaved drives shall meet the gradation requirements of either crushed gravel or crushed stone (fine) as shown in Table 1. This item shall be used for the surface course of drives which are not designated to be paved.

H. The required gradation of Crushed Stone Base Course (Fine Gradation) shall conform to Table 1 below. Acceptable sand may be blended as necessary to obtain the proper gradation for the fine aggregate portion.

I. The required gradation of Crushed Stone Base Course (Course Gradation) shall conform to Table 1. Acceptable sand may be blended as necessary to obtain the proper gradation for the fine aggregate portion.
   1. The substitution of crushed stone meeting the gradation requirements of crushed stone base course (fine gradation) for all or part of this item will not be permitted.

PART 3 EXECUTION

3.01 GENERAL

A. Upon approval, base course materials found within the project limits may be used under the specific item provided they meet the gradation requirements set forth in Table 1.

B. Permission may be given to substitute gravel or a mixture of sand and gravel for any sand course when sand is designed as part of the base. The substitution must be made across the entire section and will not be allowed for short of discontinuous segments.

C. Permission may be given to substitute crushed gravel for gravel or crushed stone (fine gradation) for crushed gravel. The substitution must be made across the entire section and will not be allowed for short or discontinuous segments.

D. Crushed aggregate base course materials shall be produced and placed in their final location with as little segregation as possible.

3.02 WINTER CONDITIONS

A. Under no circumstances shall base course materials be placed on or above frozen materials.

B. If the density requirements are not attained for any layer before the material freezes, no further material shall be placed on that layer.

3.03 PLACING

A. The base course material shall be spread in the amount necessary for proper consolidation, and shall be shaped true to grade and cross section by means of power graders or other approved equipment.

B. The subgrade or preceding course shall be shaped to the specified crown and grade and maintained in a smooth condition free of holes and ruts. If the hauling equipment should cause ruts in the subgrade or previously placed base course, the equipment shall be operated only on the course being placed, behind the spreading equipment.

C. Crushed gravel for shoulder leveling shall be spread uniformly along the area adjoining the edge of the pavement. The materials shall be spread along both sides of guardrail where there is no curb.

D. Care shall be taken to avoid segregation during placement. When base course material is dumped in piles, it shall be dumped on the course being placed and spread at once onto the previously placed layer. If spreading equipment is not available, dumping will not be permitted. Any segregation which occurs shall be remedied or the materials removed and replaced at no additional cost to the Owner.

E. Crushed aggregate shall be hauled from an approved stockpile. Material obtained directly from a conveyor will not be placed on the roadway without first stockpiling.

F. The Contractor's method of operation shall be such that oversized stones will not be delivered to the project.

G. To prevent segregation of crushed aggregate during spreading and to assist in obtaining the required density of the mixture, water may be added to the crushed aggregate prior to performing the grading operations. The course shall be maintained in the moist condition during grading operations.

H. Prior to fine grading, hard spots in the surface of the top layer shall be eliminated by scarifying the top 4 inches.

I. When the base course is to be surface-treated and no pavement is to be placed upon it, stones having any dimension greater than 3 inches shall be removed from the upper 4 inches of the top layer.

J. Surface voids in crushed stone base course (fine gradation) shall be eliminated by the addition of filler material to just fill the voids. Any surplus filler material shall be removed. The finished surface shall be uniform, true to grade, and free from segregation. The Contractor shall furnish and place filler material to correct any visible segregation prior to paving. The filler material shall be spread, scarified if required, into the course and recompacted to the required density. Filler material shall meet the gradation requirements of sand. The final gradation of crushed stone base course (fine gradation) shall meet the requirements of Table 1.

3.04 COMPACTION

A. Unless shown on the plans or ordered otherwise, the compacted depth of sand courses shall not exceed 12 inches. The compacted depth of any layer of gravel, crushed gravel, or crushed stone placed shall not exceed 8 inches. The compacted depth of any layer of crushed ledge rock shall not exceed 24 inches.

B. Compaction of base course material shall be done with approved vibratory rollers and adequate water to meet the requirements of paragraph 8. A roller producing a dynamic force of at least 27,000 pounds shall be used for layers up to 12 inches. For layers

between 12 inches and 24 inches, the roller shall produce a dynamic force of at least 42,000 pounds. Rolling and shaping shall continue until the required density is attained.

C. Rolling and shaping patterns shall begin on the lower side and progress to the higher side of the course while lapping the roller passes parallel to the centerline. Rolling and shaping shall continue until each layer conforms to the required grade and cross section and the surface is smooth and uniform.

D. Water shall be uniformly applied over the base course materials during compaction in the amount necessary for proper consolidation.

E. When vibratory equipment is being operated, the amplitude of vibrations will be adjusted as necessary to avoid causing damage to adjacent buildings and property.

F. Except at inaccessible locations, such as guard rail, material used for shoulder leveling shall be set with a pneumatic-tired roller.

G. The density of all Aggregate Base Course materials shall not be less than 95 percent of the maximum density as determined by AASHTO T 180 (Modified Proctor Density) or 95 percent of an accepted control strip. See paragraph 8.5.1.

3.05 INSPECTION AND TESTS

A. Tests Prior to Material Installation
   1. At least one test shall be made on a representative sample of each of the materials that will be used on this project. These tests shall be made by an independent testing laboratory, acceptable to the Engineer and paid by the Contractor. A copy of all test results shall be delivered to the Engineer prior to that material's incorporation into the work.

B. Tests after Material Installation
   1. The Owner reserved the right to have field gradation and compaction tests performed by an independent laboratory with all testing costs borne by the Owner subject to the provisions in Section 014000, Quality Requirements. Field density tests will be made to determine the actual in-place densities being attained.

C. Testing for Gradation
   1. Sampling procedure shall conform to AASHTO T 2. Testing procedure shall be in accordance with AASHTO T 27. Materials not meeting the gradation requirements shall not be used.
   2. The amount of material finer than the #200 sieve shall be determined according to AASHTO T 11 which specifies dry sieving after washing. Samples for acceptance testing of the material in place will be taken as the spreading operations progress on each lift just prior to the beginning of the compaction operations on that lift. For a preliminary determination of compliance with the specification for gradation, samples of sand and gravel may be taken from the pit and samples of crushed aggregate may be taken from the stockpile or from the final phase of the crushing operation.
   3. Previously tested and accepted material contaminated by earthen, organic, or other foreign matter, or degraded by hauling equipment, to such an extent

that the material no longer meets the gradation requirements, shall be removed and replaced at the Contractor's expense.

D. Density Testing
   1. The density of sand courses shall be determined by AASHTO T 191 (Sand Cone Method), AASHTO T 204 (Drive Cylinder Method), or AASHTO T 238 (Nuclear Methods).
   2. The density of gravel and crushed gravel courses shall be determined by AASHTO T 191 (Sand Cone Method), or AASHTO T 238 (Nuclear Methods). The density of crushed stone base courses will be determined by the Nuclear Method.

E. Control Strip Procedure
   1. At the beginning of the compaction operation a control strip of at least 100 lineal feet in length and spanning the width of the section being placed may be constructed. The density requirement shall be determined by compacting the control strip at a suitable moisture content until no further increase in density can be measured. The remainder of the course shall be compacted to a density not less than 95 percent of the maximum control strip density, as measured by the nuclear density testing equipment. A new control strip will be required when there is a significant change in the gradation of the material being placed, or a change in compaction equipment. Compaction of the control strip shall be done with approved vibratory rollers or compactors capable of producing a dynamic force of at least 27,000 pounds.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Aggregate Base Course will be measured for payment at the Contract unit price per cubic yard (CY).

4.02 PAYMENT

A. The accepted quantity of Aggregate Base Course including full compensation for furnishing, transporting, hauling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per cubic yard (CY).

Pay Item	Pay Unit
321123.01	Cubic Yard (CY)

END OF SECTION 321123

SECTION 321313

CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete paving, concrete sidewalks and concrete cast-in-place curbs to be installed around the trench drain repair area as shown in the Contract Drawings.

1.02 RELATED SECTIONS

A. Contract Drawings.

B. Section 033000 – Cast-in-place Concrete.

C. Section 321123 – Aggregate Base Course.

D. General Requirements.

1.03 REFERENCES

A. American Concrete Institute (ACI)
   1. 117 – Specification for Tolerances for Concrete Construction and Materials
   2. 212 – Admixtures for Concrete
   3. 301 – Standard Specification for Structural Concrete.
   4. 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   5. 305R – Guide to Hot Weather Concreting.
   6. 306R – Guide to Cold Weather Concreting.
   7. 308 – Guide to Curing Concrete.
   8. 309 – Guide for Consolidation of Concrete.
   9. 318 – Building Code Requirements for Structural Concrete.

B. ASTM International (ASTM)
   1. C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. C33 – Standard Specification for Concrete Aggregates.
   3. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. C94 – Standard Specification for Ready-Mixed Concrete.
   5. C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   6. C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
   7. C150 – Standard Specification for Portland Cement.
   8. C171 – Standard Specification for Sheet Materials for Curing Concrete.
   9. C172 – Standard Practice for Sampling Freshly Mixed Concrete.
   10. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   11. C260 – Standard Specification for Air Entraining Admixtures for Concrete.
   12. C295 – Standard Guide for Petrographic Examination of Aggregates for Concrete.

13. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. C330 – Standard Specification for Lightweight Aggregates for Structural Concrete.
15. C494 – Standard Specification for Chemical Admixtures for Concrete.
16. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. C1064 - Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
18. C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
19. D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
20. D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
21. D1752 – Standard Specification for Preformed Sponge Rubber and Cork and Recycled Expansion Joint Fillers for Concrete Paving and Structural Construction.
22. D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials project conditions, weather, test results, or other circumstances warrant adjustments.

D. Batch slips certifying concrete mix, air content, slump, and time of loading.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials and aggregate.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures, including integral color admixture.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or adhesive.
   8. Joint fillers and sealants.
   9. Protective coatings

G. Shop Drawings of all score and expansion joint layouts conforming to requirements of colored concrete patterns and project requirements.

H. Submit concrete color charts for color concrete pavement selection.

I. Submit Sample and data on plastic slip dowel system

1.05 QUALITY ASSURANCE

A. Reference Section 01400 – Quality Control.

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Facilities."

D. Testing Agency Qualifications: An independent agency qualified to according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

F. ACI Publications: Comply with the following:
   1. ACI 301
   2. ACI 117

G. Maintain one copy of each document on site.

H. Acquire cement and aggregate from one source for Work.

I. Conform to ACI 305R when concreting during hot weather.

J. Conform to ACI 306R when concreting during cold weather.

K. Materials and installed work may require testing and retesting at any time during progress of work. Retesting of rejected materials for installed work shall be done at the Contractor's expense.

L. Do not use admixtures such as calcium chloride that will cause accelerated setting of the cement in concrete.

M. The Contractor is responsible for employing an independent accredited testing laboratory, acceptable to the Design Engineer and Owner.

N. Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance, and strength as specified and indicated.

O. Walks, parking spaces and loading zones constructed for use by persons with accessibility challenges shall conform to the applicable portions of the American With Disability Act Accessibility Guidelines (ADA) and the International Building Code.

1.06 DELIVERY, STORAGE AND HANDLING

A. Reference Section – 01500 Construction Facilities and Temporary Controls.

B. Order concrete from batching plant so that trucks arrive at discharge locations when the concrete is required. Avoid excessive mixing of concrete or delays in placing successive layers of concrete in forms.

C. The concrete supplier shall deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water-cement ratio, slump, air-entrainment, temperature and homogenity.

D. Deliver concrete in order that the contractor can accept delivery within 90 minutes after batching or earlier during hot weather concreting as specified. Do not add retempering water, nor exceed the specified water-cement ratio.
   1. The addition of water in excess if the design water-cementitious material ratio for purposes of meeting the slump limits will not be permitted. Concrete that is not within the specified slump or water/cementitious limits at time of placement shall not be used.

E. The Contractor or Design Engineer shall reject concrete not conforming to specification, unsuitable for placement, exceeding time limitation restraints, and not having a complete delivery batch ticket.

F. Use all means necessary to protect the materials of this division before, during and after installation and to protect the installed work and materials of other trades.

G. Replacements: In the event of damage, immediately make all repairs and replacements to the approval of the Design Engineer and at no additional cost to the Owner.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities. Provide temporary barricades and warning lights as required.

PART 2 PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves of a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Conform to all State and local requirements for levels of toxicity.

2.02 STEEL REINFORCEMENT

A. Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel. Flat sheets required.

B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

D. Joint Dowel Bars: Galvanized smooth steel dowels, ASTM A 615/A 615M, Grade 60. Cut dowels true to length with ends square and free of burrs. Provide polypropylene plastic slip dowel sleeves system. System shall be similar to “speed dowel” by Aztec Concrete Accessories, or approved equal.

E. Tie Bars: ASTM A 615/A, Grade 60, deformed.

F. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI’s “Manual of Standard Practice” from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy or other dielectric-polymer coated wire bar supports.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I/II, Portland Cement, free of lumps. Use one approved brand of uniform colored cement from one mill throughout project unless otherwise approved by the Design Engineer. Reject entire shipment when cement is lumpy, wetted, partially or wholly set. Provide cement without efflorescence when tested in accordance with ASTM C67.

B. Fly Ash: ASTM C618 Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C989, Grade 100.

D. Silica Fume: ASTM C1240, Amorphous Silca.

E. Fine and Coarse Aggregates:
1. Fine: ASTM 33, clean, hard, durable, uncoated natural sand, free from silt, loam, and clay.
2. Coarse: ASTM 33, clean, hard, durable, uncoated crushed stone, maximum aggregate size 3/8".

2.04 ACCESSORIES

A. Water: ASTM C94/C 94M, Clean and potable.

B. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water reducing or water reducing/set retarding: ASTM C494, Type A or D.
2. Air entraining: ASTM C260.

C. Bonding Agent: Mix consisting of 1 part Portland cement and 1 part fine aggregate complying with ASTM C 144 except 100 percent passing a No. 16 (1.18 mm) sieve.

D. Curing Compound: ASTM C309, Type 1, Class B dissipating.
1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to the following:
   a. Dayton Superior Corp; Clear Dissipating Cure EF
   b. Vexcon Chemicals, Inc.; Harris Kurseal 800 White
   c. W.R. Meadows of PA; SEALTIGHT 1100 – Clear Concrete Curing Compound
   d. Or Approved Equal

E. Curing Paper: ASTM C 171, waterproof paper or polyethylene film.

2.05 CONCRETE MIX

A. Ready-mixed air-entrained concrete secured from a batch or mixing plant concrete in accordance with ASTM C94.

B. Design concrete to yield characteristics indicated on the Contract Drawings.

C. Maintain a maximum water-cement ratio of 0.40. Ratio shall be total water in mix at time of mixing, including free water, water in aggregates and admixtures.

D. Maximum concrete slump is 7 inches. Determine concrete slump in conformance with ASTM C143.

E. Use accelerating admixtures in cold weather only when approved by the Design Engineer. Use of admixtures will not reduce cold weather placement requirements.

F. Use set retarding admixtures during hot weather only when approved by Design Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior. Air content shall be 7 ± 1.5%.

H. Cementitious Materials: Limit percentage by weight of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 25 percent
   2. Ground Granulated Blast-Furnace Slag: 50 percent
   3. Silica Fume Admixture: 10 percent

2.06 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt saturated, cellular fibers, Sealtight or approved equal, as distributed by A.H. Harris, New Britain, CT.
   1. Thickness – one-half inch.
   2. Depth – to match full section of concrete pavement/curb.

B. Joint Sealer: Compatible with filler strips, two component polyurethane elastomeric type complying with FS-TT-S-00227, self leveling designed for pedestrian and vehicular traffic, as manufactured by Sika, Percora, or approved equal. Include primer and backing rods as required.
   1. Type: Class II, non-loading bearing, for bonding freshly mixed to hardened concrete.
   2. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   3. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Protective Sealer: Boiled Linseed Mixture shall be composed of 50 percent double boiled linseed oil and 50 percent petroleum spirits, by volume.

PART 3 EXECUTION

3.01 PREPARATION

A. Proof-roll prepared surface to check for unstable areas and verify need for additional compaction. Proceed with concrete pavement only after nonconforming conditions have been corrected and sub grade is ready to receive pavement. Do not install concrete over saturated, muddy or frozen base.

B. Remove loose material from compacted base surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement and curbs to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement. At points where changes in rates of grades is more than 2% introduce approved vertical curve. No abrupt changes in grade will be accepted.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

C. Curb forms to be true to horizontal and vertical alignment. Forms to be true to radiuses specified.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
   1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lap splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

A. General: Construct construction, expansion, score joints, and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated. Approval required prior to pour.
   1. Locate expansion joints at intervals of 20 feet maximum, unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler ½ inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal cap after concrete has been place on both side of joint.
7. Install dowel bars and support assemblies at joints where and as indicated.

C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
3. Provide tie bars at sides of pavement strips where indicated.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Score Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks (tool wings) on concrete surfaces. Maximum spacing 6’0” in any dimension. Areas of concrete sidewalk replacement shall be patterned to match existing pavement. Joints to be straight or true to radius shown – poor workmanship is just cause for rejection of pavement.
   a. Radius: ¼ inch.

2. Sawed Joints: Form contraction joints with poser saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: ¼ inch.

F. Rub all exposed vertical faces of curbs to eliminate blemishes, pockmarks, honeycombing, and all other defects. Plastering is not permitted.

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Protect adjacent work from damage, splatter, and all other concrete operations.

B. Remove snow, ice, or frost from sub base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten sub base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and sub grade just before placing concrete. Keep sub grade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

A General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating (broom finishing) operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power driven floats, or by hand floating if area is small or inaccessible to poser units. Finish surfaces to true planes. Cut down high spots, and fill low spots.

1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic (handicap access ramps).

3.07 CONCRETE PROTECTION AND CURING

A. Reference Section 01500 – Construction Facilities and Temporary Controls.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water
   b. Continuous water-fog spray
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof.

3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: ¼ inch.
2. Thickness: Plus 3/8 inch, minus ¼ inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed ¼ inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: ¼ inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel ¼ inch per 12 inches.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel ¼ inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus ¼ inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

B. Typical cross slope of pavement is 2.0% unless otherwise indicated. In no case will water be allowed to stand or puddle on any finished pavement.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing shall be performed according to the following requirements:
1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not les than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated.

Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.

6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. Yd., but less than 25 cu. Yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required
7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
8. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
10. Strength level of concrete will be considered satisfactory if average of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28 day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing agency shall make additional tests for the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as

clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

3.11 PAVEMENT MARKINGS

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of Concrete Sidewalk will be measured for payment at the Contract unit price per square foot (SF).

B. The quantity of Cast-In-Place Concrete Curb will be measured for payment at the Contract unit price per linear foot (LF).

C. The quantity of Concrete Paving will be measured for payment at the Contract unit price per square foot (SF).

4.02 PAYMENT

A. The accepted quantity of Concrete Sidewalk including full compensation for furnishing, transporting, hauling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot (SF)

Pay Item	Pay Unit
321313.01	Square Foot (SF)

B. The accepted quantity of Cast-In-Place Concrete Curb including full compensation for furnishing, transporting, hauling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per linear foot (LF).

Pay Item	Pay Unit
321313.11	Linear Foot (LF)

C. The accepted quantity of Concrete Paving including full compensation for furnishing, transporting, hauling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per square foot (SF).

Pay Item	Pay Unit
321313.21	Square Foot (SF)

END OF SECTION 321313

SECTION 32 3119
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

B. Decorative aluminum fences.

1.02 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2015.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM B117 - Practice for Operating Salt Spray (Fog) Apparatus; 2011.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

E. ASTM D523 - Standard Test Method for Specular Gloss; 2008.

F. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint; 2002 (Reapproved 2009).

G. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings; 2013.

H. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2008.

I. ASTM D2244 - Test Method for Calculations of Color Differences from Instrumentally Measured Color Coordinates; 2011.

J. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2010).

K. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test; 2009e2.

L. ASTM F2408 - Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2011.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
   2. Foundation details, concrete design mix and reinforcing schedule for anti-ram barrier system.

C. Installer's Qualification Statement.

D. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.07 WARRANTY

A. Finish: 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Fences:
   1. Ameristar Perimeter Security, USA: www.ameristarfence.com.
   2. Middlebury Fence Co.

2.02 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
   1. Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.

B. Electro-Deposition Coating: Multi-stage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils (0.058 mm), minimum.
   2. Color: As selected by Architect from manufacturer's standard range.
   3. Coating Performance: Comply with general requirements of ASTM F2408.
      a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
      b. Corrosion Resistance: ASTM B117, D 714 and D 1654; 1/8 inch (15.8 mm) coating loss or medium No.8 blisters after 1,500 hours.
      c. Impact Resistance: ASTM D2794; 60 inch pounds (6.8 N m).
      d. Weathering Resistance: ASTM D523, D822/D822M and D2244; less than 60 percent loss of gloss.

C. Steel: ASTM A653/A653M; tensile strength 45,000 psi (310 MPa), minimum.
   1. Hot-dip galvanized; A 653/A653M, G60.
   2. 62 percent recycled steel, minimum.

D. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

E. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
   1. Tamper-proof security bolts.
   2. Self-drilling hex-head screws.

2.03 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting requirements of ASTM F2408 for Industrial class.
   1. Fence Panels: 4 feet (1.2 meters) high by 6 feet (1.8 meters) long.
      a. Panel Style: Two rail.
      b. Panel Strength: Capable of supporting 270 pounds (122.5 kg) minimum load applied at midspan without deflection.
      c. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
   2. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
   3. Rails: Extruded aluminum channels.
      a. Double-walled aluminum U channel; outside cross-section dimensions of 1-3/4 inch (44.5 mm) square; interior guide channel forms lower limit of raceway for retaining rod.
      b. Enclosed Retaining Rod: 0.125 inch (3.17 mm) diameter galvanized steel with variable pitch connection system for high angle racking and elimination of external fasteners.
      c. Picket-to-Rail Intersection Seals: PVC grommets.
      d. Picket Spacing, Specialty: Manufacturer's specialty option.
   4. Pickets: Extruded aluminum tubes.
      a. Size: 1-1/4 inch (31.7 mm) square.
      b. Style: Pickets with finial extend above top rail.
      c. Integrally Formed Finial: Spear point.
   5. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; all fasteners factory finished to match fence.
   6. Accessories: Aluminum castings, extrusions and cold-formed strips; factory finished to match fence.
   7. Color: Manufacturer's standard, factory applied Black.
   8. Products:
      a. Ameristar Perimeter Security, USA; Echelon II; www.ameristarfence.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Decorative Aluminum Privacy Fence and Swinging Gates:
   1. Fence Panels: Formed aluminum sheets; 5 feet (1.5 meters) high by 6 feet (1.8 meters) long.
      a. Panel Style: Board-on-board.
      b. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
   2. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
   3. Color: Manufacturer's standard, factory applied Black.
   4. Products:
      a. Alumi-Guard, Inc., Privacy Fences; Fortress Shadowbox: www.alumi-guard.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Design Team of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:
   1. Removing all metal shavings from cut area.
   2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
   3. Apply 2 coats of custom finish spray paint matching fence color.
   4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.

D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
   1. Base type and quantity of gate hinges o the application; weight, height, and number of gate cycles.
   2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
   3. Provide gate hardware by the manufacturer of the gate and install per manufacturer's recommendations

3.04 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6.3 mm).

B. Maximum Offset From Indicated Position: 1 inch (25.4 mm).

C. Minimum distance from property line: 6 inches (152 mm)..

3.05 CLEANING

A. Leave immediate work area neat at end of each work day.

B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

C. Clean fence with mild household detergent and clean water rinse well..

D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

E. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color to fence finish.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

PART IV MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. The quantity of fences and gates will be measured for payment at the Contract unit price per Lump Sum.

4.02 PAYMENT

A. The accepted quantity fences and gates including full compensation for performing the work specified, including all other accessory materials, and for furnishing all materials, including labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price per Lump Sum.

Pay Item	Pay Unit
10 1400.01	Lump Sum

END OF SECTION

SECTION 329119

LANDSCAPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Topsoil.
   3. Fertilizer.
   4. Seed.
   5. Mulch.
   6. Asphalt emulsion.
   7. Preparation of seed bed.
   8. Fertilizing.
   9. Seeding.
   10. Mulching.
   11. Emulsion.
   12. Maintenance.

B. The Contractor shall restore and replace shrubbery, fencing, sod, or other disturbed surfaces or structures to conditions equal to that before the work began and to the satisfaction of the Engineer and Owner.

C. Work associated with this Section is found in other Sections of the Contract. The Contractor shall comply with all Sections of the Contract in construction of the elements of this Section.

D. All landscaping and restoration shall be performed to the satisfaction of the Owner.

1.03 SUBMITTALS

A. The Contractor shall submit manufacturer's data for all products to be applied for lawn restoration and landscaping. Submit detailed plans showing landscaping to be performed.

B. All landscape plans shall be approved by the Owner and Engineer prior to installation. Application of unapproved materials shall be replaced by the Contractor at no cost the Owner.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve and shall contain not less than 5 percent or more than 20 percent organic matter as determined by loss on ignition of samples oven-dried to constant weight at 212 Degrees Fahrenheit.

2.02 FERTILIZER

A. Fertilizer shall be lawn or turf grade 12-12-12.

2.03 SEED

A. Lawn Areas

1. All areas to be seeded which are lawn areas, whether residential, commercial, or office areas, where lawns are, or have been regularly maintained, shall be seeded with the following mixture or a mixture as required by the Soil Conservation District or other governing authority: (Percentages are by weight.)

   a. 40 percent Kentucky Bluegrass (Poa pratensis); 40 percent Creeping Red Fescue (Festuca rubra); and 20 percent Annual Ryegrass (Lolium multiflorum).

2. Where sod is required, the sod shall be green, freshly cut, and of good quality with grass free from all noxious weeds. It shall contain all the dense root system of the grass and shall not be less than 1/2" thick.

B. All Other Areas

1. All other areas shall be seeded with the following mixture:

   a. 90 percent Perennial Ryegrass (Lolium perenne) and 10 percent Alsike Clover (Trifolium hybridum)

2.04 MULCH

A. Mulch shall be straw reasonably free of weed seed and any foreign materials which may affect plant growth. Other materials may be used if approved by the Engineer.

2.05 ASPHALT EMULSION

A. Emulsion shall be non-toxic to plants and shall conform to AASHTO M140 or AASHTO M208.

PART 3 EXECUTION

3.01 PREPARATION OF SEED BED

A. Topsoil Areas

1. If suitable topsoil is available as part of the excavated material it shall be removed, stored, and used to backfill the top 4 inches of the excavation. All grass, weeds, roots, sticks, stones, and other debris are to be removed and the topsoil carefully brought to the finished grade by raking.

B. Non-Topsoil Areas

1. In lawn areas where there is a deficiency of suitable topsoil, the Contractor shall furnish 4 inches of topsoil to be used as a seed bed.

2. In areas not considered lawn areas, and where approved by the Engineer, the trench backfill may be used as a seed bed. After the backfill has been given a reasonable time to settle, it shall be graded off to the finished grade and harrowed to a depth of 3 inches. All grass, weeds, roots, sticks, stones, and other debris are to be removed and the soil carefully brought to the finished grade by raking.

3.02 FERTILIZING

A. Fertilizer shall be uniformly applied to all areas to be seeded at the rate of 1 pound per 100 square feet in topsoil or 2 pounds per 100 square feet in non-topsoil. The fertilizer shall be thoroughly disked, harrowed, or raked into the soil to a depth of not less than 2 inches. Immediately before sowing the seed, the Contractor shall rework the surface until it is a fine, pulverized, smooth seed bed, varying not more than 1 inch in 10 feet.

3.03 SEEDING

A. Immediately after the preparation and fertilization of the seed bed, the seed shall be thoroughly mixed and then evenly sown over the prepared areas at the rate of 3 pounds per 1,000 square feet. Seed shall be sown dry or hydraulically. After sowing, the area shall be raked, dragged, or otherwise treated to cover the seed to a depth of approximately 1/4".

B. Areas with slopes greater than 10% shall be sodded.

3.04 MULCHING

A. Within 48 hours after any given area is seeded, mulching material shall be evenly placed over all seeded areas at the rate of approximately 2 tons per acre, when seeding is performed between the dates of March 15 and October 15 of the same year, and at the approximate rate of 3 tons per acre when seeding is performed between the dates of October 15 and March 15 of the succeeding year.

3.05 EMULSION

A. Mulching materials shall be kept in place with asphalt emulsion applied at a minimum rate of 60 gallons per ton of mulch or by methods as are approved or may be otherwise required to prevent displacement of material. Mulching which is displaced shall be replaced at once but only after the seeding or other work which preceded the

mulching and which work was damaged as a result of displacement of mulching material has been acceptably repaired.

3.06 MAINTENANCE

A. All seeded and sodded areas shall be carefully maintained, tended, and watered by the Contractor as necessary to secure a good turf. Settled areas shall be filled, graded, and reseeded or resodded. The Contractor shall be responsible for the condition of the seeded and sodded areas for a period of one year from the date of final completion.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

B. The quantity of Landscaping will be measured for payment at the Contract unit price of lump sum.

4.02 PAYMENT

C. The accepted quantity of Landscaping including full compensation for detailing, furnishing, handling, transporting, and placing the material specified, including surface preparation, and furnishing all labor, tools, equipment, and incidentals necessary to complete the work will be paid for at the Contract unit price of lump sum.

Pay Item	Pay Unit
329119.11	Lump Sum

END OF SECTION 329119

SUPPLEMENTAL SPECIFICATIONS

The following Supplemental Specifications are to be used in conjunction with the Project Technical Specifications and are herein made a part of the Contract Documents and apply to this project:

Supplemental Specifications

Not Used.

SPECIAL PROVISIONS

The following Special Provisions are to be used in conjunction with the Project Technical Specifications and are herein made a part of the Contract Documents and apply to this project:

Special Provisions

Not Used.

NOT FOR CONSTRUCTION
THESE CONTRACT DOCUMENTS ARE FOR REFERENCE AND VIEWING ONLY

Appendix A

Pre-Qualification of Contraction Contractors Application

NOT FOR CONSTRUCTION
THESE CONTRACT DOCUMENTS ARE FOR REFERENCE AND VIEWING ONLY

City of Burlington

Pre-Qualification of Construction Contractors Application

Project Name: _____

Bid Due Date: _____

TO BE FILLED OUT BY CITY OF BURLINGTON ONLY:

Date Received: _____

Date Checked: _____

Checked By: _____

Available for Electronic Mailing

Check List for Required Items:

- ☐ One copy of the questionnaire completed in its entirety.
- ☐ Questionnaire must be completely executed and properly sworn to before a Notary Public.
- ☐ Financial Statements which are compiled, reviewed, or fully-audited must be prepared and certified by an Independent Certified Public Accountant (CPA).
- ☐ Verification of OSHA statement and reported events with the establishment search feature at: https://www.osha.gov/oshstats/
- ☐ State of Vermont Pre-Qualified approved work type documentation, if applicable

Pre-Qualification of Construction Contractors Application

This is an application for pre-qualification of construction contractors for the City of Burlington under Chapter 21 of the Code of Ordinances. The purpose of the application is to solicit information necessary to determine whether a contractor applying for work on a government funded project is a responsible contractor.

1. Policy

It is the policy of the City of Burlington to let contracts for city construction projects only to contractors and subcontractors that demonstrate that they are responsible contractors.

2. Responsible Contractor

Responsible contractors are those contractors and subcontractors who have demonstrated to the city that they are financially responsible, have experience suggesting that they have the ability to perform government projects responsibly, have demonstrated that they are responsible employers, and have demonstrated that they have fair subcontractor relations, or that they perform all work with their own forces.

3. Minimum Contract Amount

This pre-qualification requirement applies to any construction contract by a department, board or council of the City, or those construction projects financed by tax exempt bonds issued by the Burlington Community Development Corporation, in which the total project cost is $100,000 or more.

4. Contracting Authority

This application is to be delivered to the contracting authority under the schedule determined by that authority as part of the bidding process. The contracting authority is the department, board or council, agency, or entity that is sponsoring the contract on behalf of a government funded project.

5. Proprietary Information

All information submitted by contractors and subcontractors in connection with a pre-qualification application shall be considered proprietary information. The City shall not release the information except as may be required by the Access to Public Records Law, or by court order.

6. Subcontract Work

The pre-qualification requirement does not apply to subcontractors where the total value of the work to be performed is less than $7,500.

Instructions for Filing the Questionnaire, Financial Statement and Other General Information For Contractors

1. Preparation of Statement:

One copy of the questionnaire is required by the City. It must be completely executed and properly sworn to before a Notary Public. Financial Statements which are compiled, reviewed, or fully-audited must be prepared and certified by an Independent Certified Public Accountant (CPA). A Certified Public Accountant is considered on who, in Vermont, is registered by the State of Vermont Board of Public Accountancy as a CPA. For other states, the City will consider a CPA whose registration qualifications in their state equal those established in Vermont. This questionnaire must be submitted at least five (5) working days before the date of opening bids in order to ensure consideration for pre-qualification for a particular bid opening.

2. Notification of Action Taken:

The City will send in writing to the applicant a notification of its decision. Questionnaires will be considered in the order received and acted upon at all times as promptly as circumstances permit. Contractors duly pre-qualified will be appraised in writing of both the amount and type of work on which they will be eligible to bid.

3. Duration of Pre-Qualification:

The duration of any pre-qualification will not exceed one (1) year and will expire annually three (3) months subsequent to the closing date of the contractors fiscal year, as evidenced in their financial statement.

4. Revision of Pre-Qualification Rating:

Requests for revision of pre-qualification rating will be considered at any time provided credentials showing increased assets, equipment or ability to perform work are submitted. These must be submitted at least five (5) working days prior to a bid opening to receive consideration for that bid opening. Contractors shall also report any substantial increase in liabilities that occurs during the pre-qualification period.

5. Request for Plans, Specifications and Proposal Form:

Contractors having been duly pre-qualified will receive notices from time to time inviting submission of proposals for the contracts to be let on specified dates. A Contractor desiring to receive plans, proposal and specifications for any contract may obtain them upon written request only, utilizing the special form entitled A Standard Form B Request for Proposal and/or Plans. This form is furnished to all pre-qualified contractors by the City and this form must show the status of all work under contract or otherwise executed by the Contractor, both inside and outside the State of Vermont, as of the date of request.

PRE-QUALIFICATION OF CONSTRUCTION CONTRACTORS APPLICATION

Submitted by_____

Corporation ☐ Partnership ☐ Individual ☐ Other ☐

Mailing Address _____

_____

Location Address_____

Telephone Number _____ Federal ID Number_____

The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to interrogatories hereinafter made.

_____
Authorized Signature

_____
Date

Experience Questionnaire

How many years has your organization been in business as a general contractor under your resent business name? _____ Under other names? (List)

_____

_____

How many years experience in construction work has your organization had, (a) As a general Contractor, (b) As a Sub-Contractor: _____

_____

_____

_____

_____

Has your organization, or any officer, partner, director or principal individual thereof ever admitted to or been convicted of any criminal violation, including but not limited to discrimination, anti-trust or labor violations, other than traffic offences; or been convicted of or is currently being sued for any civil antitrust violation or other civil suit involving fraud; or been debarred from performing work on any contract?

If so, give full details, including the name of any individual involved and the court and docket number of any civil or criminal actions:

_____

_____

_____

Date of reinstatement_____

2. Is your organization currently debarred from performing work on any contract? YES / NO

   If yes, by whom? _____

   Date of reinstatement: _____

3. Has your organization ever been denied pre-qualification? YES / NO

   If so, by whom and for what reason? _____

   _____

   _____

4. Have you ever failed to complete any work awarded to you? YES / NO

   If so, where and why? _____

   _____

   _____

5. Has any officer, director or partner of your organization ever been an officer or partner of some other organization that failed to complete a construction contract? YES / NO

   If so, state the name of individual, other organization and reason therefore:

   _____

   _____

   _____

6. Has any officer, director or partner of your organization ever failed to complete a construction contract handled in his own name? YES / NO

_____

_____

If so, state name of individual, name of owner and reason therefore: YES / NO

_____

_____

7. Has the organization been cited in the past three (3) years for violations of OSHA?

If so, please explain: YES / NO

_____

_____

8. Has the organization currently any outstanding legal action against it by a subcontractor on a current or former job? YES / NO
If so, please explain:

_____

_____

9. List all parents, subsidiaries, affiliates or divisions of your firm, and any related parties included in disclosures in your most recent financial statements or the notes thereto:

_____

_____

10. List any of your officers, shareholders or directors that are affiliated with any other contractor and/or supplier:

_____

_____

11. Identify all persons having final bidding authority and/or the Chief Estimator:

_____

_____

12. Give names and complete addresses of three (3) major material suppliers and/or subcontractors with whom your firm has done business in the past 3 years:

_____

_____

_____

13. List the names and addresses of the following:

Bank:

_____

_____

Amount of Letter of Credit:

_____

_____

Bonding Co. and limit (Please specify per project and aggregate limits):

_____

_____

Bonding Agent:

_____

_____

Liability Insurance:

Name of Carrier:

_____

_____

Limits of Liability:

_____

_____

Worker's Compensation:

Name of Carrier:

_____

_____

14. Does the organization have a company safety program, such as, a currently approved VOSHA plan in place? YES / NO

If so, briefly describe:

_____

_____

15. List the average wages and benefits paid by the organization over the past year for the skills, trades and job classifications intended to be employed for the contract (s) under consideration in this pre-qualification:

Job Title	Hourly wages	Health Insurance
CARPENTER		
ELECTRICIAN		
PAINTERS		
PIPEFITTERS		
PLUMBERS		
ROOFERS		
POWER EQUIPMENT OPERATORS		
TRUCKER DRIVERS		
LABORERS		
OTHERS		

16. List specific projects which your organization has completed in the last five years (Attach additional sheet if required):

Contract Amount	Type of Work	% of Subcontract	When Completed	Location	Name, Address and Telephone of Owner

17. List all field supervisory personnel and indicate their construction experience:

Name	Present Position or Office	No. of Years With this Firm	Construction Experience	Magnitude and Type of Work	In what Capacity

18. Is your firm pre-qualified by the State of Vermont? YES / NO

If so, please state rating and type of work qualified to perform:

RATING TYPE OF WORK

_____

_____

_____

_____

_____

_____

_____

Experience and Work Preference

In the following tabulation indicate the various types of work in which you are experienced and for which you desire to be qualified:

Bridge Construction	_____	Bridge Rehabilitation	_____
Railroad Signals	_____	Roads Culverts	_____
Building Construction	_____	Building Demolition	_____
Surface Rehabilitation	_____	Maintenance	_____
Tank Removal/Replacement	_____	Foundation	_____
Guard Rail, Fencing & Signs	_____	Hazardous Material Removal	_____
Construction &	_____	Landscaping	_____
Rehabilitation	_____	Pavement Markings	
Traffic Signals & Lighting	_____	Water & Sewer	_____
Road Construction	_____	Other (as specified)	_____

19. Financial Capability.

The City reserves the right to request additional information if necessary to establish financial capability.