

PROJECT MANUAL
FOR
CONSTRUCTION OF

DEER PARK SPORTS FIELDS

PROJECT A:
SOCCER FIELD DEVELOPMENT (PHASE 1)

PROJECT B:
GIRLS SOFTBALL RENOVATIONS

FOR:



BID RELEASE: 04/12/17

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**Deer Park Sports Fields: Projects A & B
Specifications
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ARCHITECT SPECIFICATIONS PROJECT - B: SOFTBALL

RESTROOM BUILDING MEP SPECIFICATIONS - PROJECT B: SOFTBALL

GENERAL REQUIREMENTS

DEER PARK SPORTS FIELDS

PROJECT A:

SOCCER FIELD DEVELOPMENT (PHASE 1)

PROJECT B:

GIRLS SOFTBALL RENOVATIONS

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by



Issued and Published Jointly by



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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. 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, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 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. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking 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. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and

Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
25. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

26. *Notice to Proceed*—A written notice 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.
27. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
28. *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.
29. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
30. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
31. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
32. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
33. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
34. *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.
35. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
36. *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, and such other lands furnished by Owner which are designated for the use of Contractor.
37. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
38. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

39. *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.
40. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
41. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
42. *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 a Subcontractor.
43. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
44. *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 but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
45. *Unit Price Work*—Work to be paid for on the basis of unit prices.
46. *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; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
47. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

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

- B. *Day*:
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- C. *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.
- D. *Furnish, Install, Perform, Provide*:
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. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- E. Unless stated otherwise in the Contract Documents, words or phrases that 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. *Bonds*: 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 Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to the Owner and Engineer:
 - 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;
 - 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.

2.04 *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 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

2.05 *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 2.03.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.
 - 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 the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

2.07 *Designation of Authorized Representatives*

- A. Prior to or within three (3) days of the Notice to Proceed, the Owner and Contractor shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, 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.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

3.02 *Reference Standards*

- A. Standards Specifications, Codes, Laws and Regulations
 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, 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, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract 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, reference standard, 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 part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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 part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then 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 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
3. Should Contractors perform the Work after discovery of such a conflict without reporting the conflict or before receipt of a clarification or interpretation by Engineer, Contractor will be solely liable for any correction or other measures that may be required to overcome the conflict or bring the Work into compliance with the Contract Documents.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence upon issuance of notice to proceed.

4.02 *Commencement of Performance*

- A. No Work shall be done at the Site prior to such date. Contractor may commence performance upon receipt of the Notice to Proceed and in accordance with any terms and dates contained therein.

4.03 *Reference Points*

- A. If applicable, Owner shall provide engineering surveys, or GPS control points 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.
- B. Contractor shall note the location of all reference points and controls on a set of red-lined drawings or exhibits to be maintained at all time on the jobsite.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. 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, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, 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 Time. 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.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. 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. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. abnormal weather conditions;
 - 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 - 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.
- H. Contractor expressly waives any right to an adjustment in Contract Price for any event of delay. Contractor's sole remedy for any delay shall be limited to an adjustment in Contract Time.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *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.
- 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 permanent improvements are to be made 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.

5.02 *Use of Site and Other Areas*

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 - 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with

such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, INDEMNIFY AND HOLD HARMLESS OWNER, ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS FROM AND AGAINST ANY SUCH CLAIM, AND AGAINST ALL 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 OR ANY OTHER PARTY INDEMNIFIED HEREUNDER TO THE EXTENT CAUSED DIRECTLY OR INDIRECTLY, IN WHOLE OR IN PART BY, OR BASED UPON, CONTRACTOR'S PERFORMANCE OF THE WORK, OR BECAUSE OF OTHER ACTIONS OR CONDUCT OF THE CONTRACTOR OR THOSE FOR WHICH CONTRACTOR IS RESPONSIBLE.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent 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 and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. Contractor accepts the responsibility to satisfy itself as to the soil conditions and nature and type of geological formations in and through which this Project will be constructed. Such information as may be obtained from the test borings and accompanying notations shown on the plans is merely for the guidance of the Contractor and is not to be construed in any manner as a guarantee by the Owner that such conditions of sub-surface strata are infallible.
- B. Contractor waives any and all rights to make a claim against Owner relating to representations related to geotechnical data provided in the contract documents, plans and specifications. The locations of the test holes, if applicable, are shown in the Geotechnical Report. Logs of these test holes are included in the Geotechnical Report. Test holes information represents subsurface characteristics to the extent indicated and only for the point location of the test hole. Contractor shall make its own interpretation of the character and condition of the materials, which will be encountered. Contractor may, at its own expense, make additional surveys and investigations as it may deem necessary to determine conditions, which will affect performance of the Work.
- C. *Reports and Drawings:* Owner will identify to the Contractor:
 - 1. any reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. any drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 3. Technical Data contained in such reports and drawings.
- D. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified by Owner with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner 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.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site 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 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; 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 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Times to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's time required for performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. 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.
 2. Contractor shall not be entitled to any adjustment in the Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor submitted its Bid or entered into the Agreement with Owner for the Project; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Times, then any such adjustment shall be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent 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 Contract Documents:
1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; 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 information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then 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 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Times Adjustments:*
 1. Contractor shall be entitled to an equitable adjustment in the Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

- b. 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; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
- 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Times then any such adjustment shall be set forth in a Change Order.
- 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Times no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- B. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- C. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) 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. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and deduct all costs incurred from the contract balance or if no contract balance, may file a claim for costs.
- D. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- E. 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, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

- 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- G. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, AND CONSULTANTS 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 FAILURE TO CONTROL, CONTAIN, OR REMOVE A CONSTITUENT OF CONCERN BROUGHT TO THE SITE BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE, OR TO A HAZARDOUS ENVIRONMENTAL CONDITION CREATED BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE.
- H. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond in accordance with chapter 2253 of the Texas Government Code. Contractor shall also furnish such other bonds as are required by other specific provisions of the Contract.
- B. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds in a form acceptable to Owner. The surety on the bonds must be duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in Texas, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide bonds from another surety, all of which shall comply with the requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

6.02 *Insurance—General Provisions*

- A. Owner is self-insured as a municipality of the State of Texas.
- B. Contractor shall provide all insurance with required by Exhibit A to these General Conditions, Owner's Insurance Requirements.

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

7.01 *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.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written consent of Owner. Such consent shall not be unreasonably withheld.

7.02 *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, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.
- C. Contractor shall provide and pay for labor in accordance with the prevailing wage in the locality and shall not pay less than the prevailing wage.

7.03 *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, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work 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.

7.04 *“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 Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to 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 is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that 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, Engineer shall deem it an “or equal” item. For the purposes of this paragraph, 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
 - 4) it is not objectionable to Owner.
 - 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.
- B. *Contractor’s Expense:* Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.
- C. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal”, which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination. Use of an unapproved “or-equal” item will render such Work defective and will be subject to Article 14 provisions.
- D. *Effect of Engineer’s Determination:* Neither approval nor denial of an “or-equal” request shall result in any change in Contract Price. The Engineer’s denial of an “or-equal” request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 3. 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:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether 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
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished,

installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- E. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- B. 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 the right of Owner to the completion of the Work in accordance with the Contract Documents.
- C. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- D. 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.
- E. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- F. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- G. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- H. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner.
- I. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

7.07 *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, ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, AND CONSULTANTS 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.

7.08 *Permits*

- A. The Owner shall waive all construction permit fees and charges assessed by entities and agencies of the City. This section is not intended to waive any permit fees or charges assessed by the departments of the state, the county or federal government. To the extent such fees are not waived, Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract).

7.09 *Taxes*

- A. The Owner enjoys tax-exempt status as a municipality. To enjoy the cost-savings benefits of its tax-exempt status, the Owner will provide a Tax Exemption Certificate to the Contractor for use on the Project. The Contractor shall use that certificate to exempt any purchases made for the Work from taxes. All savings for the tax-exempt status will be passed on to the Owner by the Contractor. The Contractor agrees to bind all Subcontractors of any tier to the obligation to present and use the Tax Exemption Certificate and pass all savings to the Owner.

7.10 *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 or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses. However, Contractor has no responsibility or liability for determining whether the Work as described in the Contract Documents complies with applicable Laws or Regulations.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Owner. Delivery of a complete set of record documents to Owner is a condition precedent to Final Completion.

7.12 *Safety and Protection*

- A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Contractor shall comply with all Laws and Regulations regarding safety and 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, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.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 at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer 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).
- F. Contractor's duties and responsibilities for safety and protection 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 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

- 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.

7.14 *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.

7.15 *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.
- B. In the event there is an accident involving injury to any individual on or near the Work, the Contractor shall notify Owner's Representative within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner, for the Owner's and Engineer's records, within forty-eight (48) hours of the event. Nothing in this section will relieve Contractor of its obligations and responsibilities with respect to an injury under any state and federal laws and regulations.

7.16 *Shop Drawings, Samples, and Other Submittals*

- A. *Shop Drawing and Sample Submittal Requirements:*
 - 1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

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 of that submittal, and that Contractor approves the 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 set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
1. *Shop Drawings:*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - 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 7.16.D.
 2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall 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 7.16.D.
 3. 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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- 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 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 of a Shop Drawing or Sample 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 7.16.A.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 will document any such approved variation from the requirements of the Contract Documents in a Field Order.

3. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
4. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
5. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

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.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

- B. The Contractor warrants and guarantees for one (1) year from Final Completion, or for a longer period if expressly stated in the Contract Documents, the Work. This includes a Warranty and Guarantee against any and all defects. The Contractor must correct any and all defects in material and/or workmanship which may appear during the Warranty and Guarantee period, or any defects that occur within one (1) year of Final Completion even if discovered more than one (1) year after Final Completion, by repairing (or replacing with new items or new materials, if necessary) any such defect at no cost to the Owner, within a reasonable period of time, and to the Owner's satisfaction.
- C. 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.
- D. 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;
 - 6. the issuance of a notice of acceptability by Engineer;
 - 7. any inspection, test, or approval by others; or
 - 8. any correction of defective Work by Owner.

7.18 *Indemnification*

- A. TO THE FULLEST EXTENT PERMITTED BY LAW, AND IN ADDITION TO ANY OTHER OBLIGATIONS OF CONTRACTOR UNDER THE CONTRACT OR OTHERWISE, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER, ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, AND CONSULTANTS 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.

7.19 *Delegation of Professional Design Services*

- A. Contractor shall not be responsible for nor warrant the adequacy of the design, performance, criteria, or design criteria specified by Owner or Engineer in the Contract Documents, Plans , and Specifications.
- B. 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 Laws and Regulations.
- C. 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, 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.
- D. Owner 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.
- E. Pursuant to this paragraph, 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 7.16.D.1.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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 such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that 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.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. 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.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at

or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) INDEMNIFY AND HOLD HARMLESS OWNER, ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, AND CONSULTANTS FROM AND AGAINST ANY SUCH CLAIMS, AND AGAINST ALL 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 DAMAGE, DELAY, DISRUPTION, OR INTERFERENCE.

ARTICLE 9 – OWNER’S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. For all Project and performance of Work matters, Owner will issue communications to Contractor through Engineer. However, Owner may, at its discretion, issue communications related to the Project directly to Contractor. In all such direct communications, Owner will endeavor to copy Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer. The replacement engineer’s status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner’s duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner’s duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

9.06 *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.

9.07 *Evidence of Financial Arrangements*

- A. Within Thirty (30) days of executing the Agreement, Contractor may request, and Owner shall furnish, reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract Documents.

9.08 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will act as the Owner's representative for Project administration during the construction period. Engineer shall not have the authority to bind the Owner as that authority lies with the Owner's designated representative, but Engineer may communicate on behalf of Owner in all Project matters.

10.02 *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'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 10.08. 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.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in this article 10.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. 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, are set forth in Paragraph 7.19.

- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

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

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Engineer's authority, responsibility and actions as Owner's representative shall not give rise to any liability to Contractor. Contractor expressly waives any claims it has against Engineer for the performance of its responsibilities as Owner's representative.
- 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.
- C. 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 15.06.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.
- D. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. A Change Order shall be used to amend or supplement the Contract Documents when the Parties agree to the amendment, supplement, modification to the scope of work, or change in the Contract Price or the Contract Times.
 - 2. *Work Change Directives:* A Work Change Directive may be issued by the Owner if the Parties cannot agree on a Change Order or if:
 - a. The parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order,

following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price.

- b. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
 - c. Upon receipt of a Change Directive, Contractor shall promptly proceed with the change in the Work involved.
3. *Field Orders:* Owner or Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-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. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *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 with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

- B. 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, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee*: When applicable, 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 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.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 Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - 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 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any

Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
 - 1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 - 2. *Engineer's Action:* Engineer will review each Change Proposal with Owner and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Engineer's action on a Change Proposal will not have the effect of adjusting the Contract Time or Contract Price without express written approval of Owner and a memorialization of Engineer's Action in a Change Order. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 - 3. *Binding Decision:* Engineer's decision will be final and binding upon Contractor, unless Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. 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;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07; and
4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety 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), 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.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The responsibility to substantiate a Claim shall rest with the party making the Claim.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, the mediation shall occur within 60 days of the agreement to mediate. However, the mediation may be stayed and its scope and schedule may be amended, provided that the mediation occur no later than 60 days following Final Completion.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

4. Mediation is a condition precedent to litigation before a court of competent jurisdiction or tribunal.
- E. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party.
- F. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise, that agreement should be memorialized in a Change Order if the Project is ongoing at the time of resolution and the agreement affects the Contract scope, price, or time.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time. 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, and vacation and holiday pay applicable thereto.
 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, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. 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 13.01.

- C. 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.
 - 1. 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, approved by Owner, 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. The cost of utilities, fuel, and sanitary facilities at the Site.
 - e. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- D. *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 employees, agents and other personnel not included in Paragraph 13.01.B, whether at the Site or in Contractor's principal or branch office for general administration of the Work. The payroll costs and other compensation excluded here 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. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- E. *Contractor's Fee:* When the Work as a whole 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, Change Proposal, Claim, set-off, or other 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 11.04.C.
- F. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, 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.

13.02 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*: Contractor agrees that:
 - 1. 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
 - 2. 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*: 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.

13.03 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. Payments to Contractor for Unit Price Work will be based on actual quantities.
- 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. 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 the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price 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;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it 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 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

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

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall be responsible for providing the services of an independent inspection and testing lab if the Contract Documents and Specifications so require.
- C. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner.

- D. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- 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, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.

- B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages*: Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, upon Owner's approval and 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, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. 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, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *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, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated.

14.07 *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, 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, then 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 14.07, 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, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. 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 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 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 during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *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, a warehouse bond, 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.

C. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, 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 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; 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; or
 - b. 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. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Reductions in Payment by Owner:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - h. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *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 and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. At that inspection, Owner and Engineer will review, supplement, and edit the initial punch list prepared by Contractor or prepare an additional punch list if Contractor has not yet provided a punch list. If Owner or Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Owner and Engineer consider the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. If Owner and Engineer do not consider the Work substantially complete, the Engineer shall notify Contractor of such, in writing, with a specific explanation of those portions of the Work that are the basis for determining the Work is not substantially complete.
- D. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

15.04 *Partial Use or Occupancy*

- 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. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03 for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work 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 Owner or 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 Owner or Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work.

4. No use or occupancy or separate operation of part of the Work by Owner will relieve Contractor of its insurance obligations under these Contract Documents.
- B. The Owner, at the Owner's sole option, shall have the right to take possession of and use any completed or partially completed portion of the Work regardless of the time for completing the entire Work. The Owner's exercise of such use and possession shall not be construed to mean that the Owner acknowledges that any part of the Work so possessed and used is substantially complete or that it is accepted by Owner, and the Owner's exercise of such use and possession shall not relieve the Contractor of its responsibility to complete all Work in accordance with the Contract Documents.

15.05 *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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *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, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other

burdens on Owner's property, 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, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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 have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary to protect Owner from loss for the reasons stated above with respect to progress payments. 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. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off) will become due and shall be paid by Owner to Contractor.

E. *Contractor's Warranty and Guarantee:* Contractor's general warranty period and guarantee will begin to run upon Final Completion as approved by City Council, and following Engineer's written recommendation.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from defective Work appearing after final inspection, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted, expressly reserved, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Final 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 in need of repair, adjustment, modification, correction, or found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as

permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
 2. correct such defective Work;
 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 to 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 repaired or may have the rejected Work removed and replaced. 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 repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- 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, 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 are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents; or
 3. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor notice that the Contract is terminated; and
 2. enforce the rights available to Owner under any applicable performance bond.
- C. If Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient. If Owner chooses to complete the Work in accordance with this provision, Owner and Contractor expressly agree that Owner shall be exempt from publicly bidding the completion work pursuant to Section 252.022 of the Texas Local Government Code.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds to complete the Work and/or correct the default, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner.
- F. 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, or any rights or remedies of Owner against Contractor or any surety.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor, 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:
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;
 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;
 3. demobilization expenses; and
 4. overhead and profit on unperformed work. .
- B. Contractor shall not be paid for any economic loss arising out of or resulting from such termination, except for those costs expressly identified above..

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 180 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) 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 16.03.
- 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. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal 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 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
 - 3. Reserved claims of Owner or Contractor under these Control Documents, including Article 12.
- B. *Final Resolution of Disputes:*
 - 1. For any disputes subject to this article, Owner and Contractor shall endeavor to resolve their Claims by mediation. The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction. Mediation is a condition precedent to litigation before a court of competent jurisdiction.
 - 2. For any claim not resolved by mediation, the parties agree to submit such claims to the jurisdiction of the District Court of Harris County, Texas for final dispute resolution.

ARTICLE 18 – MISCELLANEOUS

18.01 *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, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended;
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice; or
 - 3. delivered by electronic means with a corresponding confirmation of delivery or read receipt.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract 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, Sunday or a legal holiday, the computation of time will conclude on the next business day.

18.03 *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 special warranty or guarantee, or by other provisions of the Contract.

18.04 *Limitation of Damages*

- A. The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:
 - 1. damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
 - 2. damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, bonding capacity, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state of Texas.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

18.09 *Prevailing Wage*

- A. Contractor shall provide and pay for labor in accordance with the prevailing wage in the locality and shall not pay less than the prevailing wage.

18.10 *Right to Audit:*

- A. Whenever the Owner enters into any type of contractual arrangement with the Contractor, then the Contractor's "records" shall upon reasonable notice be open to inspection and subject to audit and/or reproduction during normal business working hours. The Owner's representative, or an outside representative engaged by the Owner, may perform such audits. The Contractor shall maintain all records relating to this Agreement for four (4) years from the date of final payment under this Agreement.
- B. The Owner shall have the exclusive right to examine the records of the Contractor. The term "records" as referred to herein shall include any and all information, materials and data of every kind and character, including without limitation records, books, papers, documents, contracts, schedules, commitments, arrangements, notes, daily diaries, reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may, in the Owner's judgment, have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any contract document. Such records shall include (hard copy, as well as computer-readable data if it can be made available), written policies and procedures, time sheets, payroll registers, cancelled checks, personnel file data, correspondence, general ledger entries, and any other record in the Contractor's possession which may have a bearing on matters of interest to the Owner in connection with the Contractor's dealings with the Owner (all of the foregoing are hereinafter referred to as "records"). In addition, the Contractor shall permit interviews of employees as well as agents, representatives, vendors, subcontractors and other third parties paid by the Contractor to the extent necessary to adequately permit evaluation and verification of the following:
 - 1. The Contractor's compliance with contract requirements;
 - 2. The Contractor's compliance with the Owner's business ethics policies; and
 - 3. If necessary, the extent of the Work performed by the Contractor at the time of contract termination.
- C. The Contractor shall require all payees (examples of payees include subcontractors, insurance agents, material suppliers, etc.) to comply with the provisions of this Article 18.01 by securing the requirements hereof in a written agreement between the Contractor and payee. Such requirements include a flow-down right of audit provision in contracts with payees that also apply to subcontractors and sub-subcontractors, material suppliers, etc. The Contractor shall cooperate fully and shall require Related Parties and all of the Contractor's subcontractors to cooperate fully in furnishing or in making available to the Owner from time to time whenever requested, in an expeditious manner, any and all such information, materials, and data.

- D. The Owner's authorized representative or designee shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this Agreement, and shall be provided adequate and appropriate work space in order to conduct audits in compliance with this Article 18.10.

- E. If an audit inspection or examination in accordance with this Article 18.10 discloses overpricing or overcharges of any nature by the Contractor to the Owner in excess of one-half of one percent (.5%) of the total contract billings, then the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by the Contractor. Any adjustments and/or payments, which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records, shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of the Owner's findings to the Contractor.

Exhibit A.
Owner's Insurance Requirements of Contractor

1. Specific Insurance Requirements

The following insurance shall be maintained in effect with limits not less than those set forth below at all times during the term of this Agreement and thereafter as required:

Insurance	Coverage/Limits	Other Requirements
Commercial General Liability (Occurrence Basis)	Amounts of coverage shall be no less than: ▪ \$1,000,000 Per Occurrence ▪ \$2,000,000 General Aggregate ▪ \$2,000,000 Products/Completed Operations Aggregate ▪ \$1,000,000 Personal And Advertising Injury ▪ Designated Construction Project(s) General Aggregate Limit	▪ Current ISO edition of CG 00 01 ▪ Additional insured status shall be provided in favor of Owner Parties on a combination of ISO forms CG 20 10 04 13 and CG 20 37 04 13. ▪ This coverage shall be endorsed to provide primary and non-contributing liability coverage. It is the intent of the parties to this Agreement that all insurance coverage required herein shall be primary to and will not seek contribution from any other insurance held by Owner Parties, with Owner Parties' insurance being excess, secondary and non-contributing. ▪ Stop Gap coverage shall be provided if any work is to be performed in a monopolistic workers' compensation state. ▪ The following exclusions/limitations (or their equivalent(s), are prohibited: - o Contractual Liability Limitation CG 21 39 - o Amendment of Insured Contract Definition CG 24 26 - o Limitation of Coverage to Designated Premises or Project, CG 21 44 - o Exclusion-Damage to Work Performed by Subcontractors On Your Behalf, CG 22 94 or CG 22 95 - o Exclusion-Explosion, Collapse and Underground Property Damage Hazard, CG 21 42 or CG 21 43 - o Any Classification limitation - o Any Construction Defect Completed Operations exclusion - o Any endorsement modifying the Employer's Liability exclusion or deleting the exception to it - o Any endorsement modifying or deleting Explosion, Collapse or Underground coverage - o Any Habitational or Residential exclusion applicable to the Work - o Any "Insured vs. Insured" exclusion except Named Insured vs. Named Insured - o Any Punitive, Exemplary or Multiplied Damages exclusion - o Any Subsidence exclusion

Business Auto Liability	Amount of coverage shall be no less than: ▪ \$1,000,000 Per Accident	▪ Current ISO edition of CA 00 01 ▪ Arising out of any auto (Symbol 1), including owned, hired and nonowned
Workers' Compensation and Employer's Liability	Amounts of coverage shall be no less than: ▪ Statutory Limits ▪ \$1,000,000 Each Accident and Disease ▪ Alternate Employer endorsement ▪ USL&H must be provided where such exposure exists.	▪ The State in which work is to be performed must listed under Item 3.A. on the Information Page ▪ Such insurance shall cover liability arising out of the Contractor's employment of workers and anyone for whom the Contractor may be liable for workers' compensation claims. Workers' compensation insurance is required, and no "alternative" forms of insurance shall be permitted. ▪ Where a Professional Employer Organization (PEO) or "leased employees" are utilized, Contractor shall require its leasing company to provide Workers' Compensation insurance for said workers and such policy shall be endorsed to provide an Alternate Employer endorsement in favor of Contractor and Owner. Where Contractor uses leased employees with Workers' Compensation insurance provided by a PEO or employee leasing company, Contractor is strictly prohibited from subletting any of its work without the express written agreement of Owner.
Excess Liability (Occurrence Basis)	Amounts of coverage shall be no less than: ▪ \$5,000,000 Each Occurrence ▪ \$5,000,000 Annual Aggregate	▪ Such insurance shall be excess over and be no less broad than all coverages described above. ▪ Drop-down coverage shall be provided for reduction and/or exhaustion of underlying aggregate limits and shall include a duty to defend any insured.
Professional Liability	Amounts of coverage shall be no less than: ▪ \$1,000,000 Each Occurrence ▪ \$2,000,000 Annual Aggregate ▪ If a combined Contractor's Pollution Liability and Professional Liability policy is utilized, the limits shall be \$3,000,000 Each Loss and Aggregate. ▪ Such insurance shall cover all services rendered by the Contractor and its consultants under the Agreement, including but not limited to design or design/build services. ▪ Policies written on a Claims-Made basis shall be maintained for at least two years beyond termination of the Agreement.	▪ Such insurance shall cover all services rendered by the Contractor and its subcontractors under the Agreement. ▪ This insurance is not permitted to include any type of exclusion or limitation of coverage applicable to claims arising from: - o bodily injury or property damage where coverage is provided in behalf of design professionals or design/build contractors - o habitational or residential operations - o mold and/or microbial matter and/or fungus and/or biological substance - o punitive, exemplary or multiplied damages. ▪ Any retroactive date must be effective prior to beginning of services for the Owner. ▪ Policies written on a Claims-Made basis shall have an extended reporting period of at least two years beyond termination of the Agreement. Vendor shall trigger the extended reporting period if identical coverage is not otherwise maintained with the expiring retroactive date.

Contractors Pollution Liability	Amounts of coverage shall be no less than: ▪ \$1,000,000 Each Loss ▪ \$2,000,000 Annual Aggregate ▪ If a combined Contractor's Pollution Liability and Professional Liability policy is utilized, the limits shall be \$3,000,000 Each Loss and Aggregate. ▪ The policy must provide coverage for: ○ the full scope of the named insured's operations (on-going and completed) as described within the scope of work for this Agreement ○ loss arising from pollutants including but not limited to fungus, bacteria, biological substances, mold, microbial matter, asbestos, lead, silica and contaminated drywall ○ third party liability for bodily injury, property damage, clean up expenses, and defense arising from the operations; ○ diminution of value and Natural Resources damages ○ contractual liability ○ claims arising from non-owned disposal sites utilized in the performance of this Agreement.	▪ The policy must insure contractual liability, name Owner Parties as an Additional Insured, and be primary and noncontributory to all coverage available to the Additional Insured. ▪ This insurance is not permitted to include any type of exclusion or limitation of coverage applicable to claims arising from: ○ Insured vs. insured actions. However exclusion for claims made between insured within the same economic family are acceptable. ○ impaired property that has not been physically injured ○ materials supplied or handled by the named insured. However, exclusions for the sale and manufacture of products are allowed. Exclusionary language pertaining to materials supplied by the insured shall be reviewed by the certificate holder for approval. ○ property damage to the work performed by the contractor ○ faulty workmanship as it relates to clean up costs ○ punitive, exemplary or multiplied damages ○ work performed by subcontractors ▪ If coverage is provided on a Claims Made basis, coverage will at least be retroactive to the earlier of the date of this Agreement or the commencement of contractor services relation to the Work. ▪ The policy will offer an extended discovery or extended reporting clause of at least three (3) years. ▪ Completed Operations coverage shall be maintained through the purchase of renewal policies to protect the insured and additional insured for at least two (2) years after the property owner accepts the project or this contract is terminated. The purchase of an extended discovery period or an extended reporting period on a Claims Made policy or the purchase of occurrence based Contractors Environmental Insurance will not be sufficient to meet the terms of this provision.
Builders Risk	▪ Coverage shall be provided in an amount equal at all times to the full contract value, including change orders, and cost of debris removal for any single occurrence. ▪ Coverage shall be at least as broad as an unmodified ISO Special form, shall be provided on a completed-value basis, and shall be primary to any other insurance coverage available to the named insured parties, with that other insurance being excess, secondary and non-contributing. ▪ The policy must provide coverage for:	▪ Insureds shall include Owner, General Contractor, all Loss Payees and Mortgagees, and subcontractors of all tiers in the Work as Insureds. ▪ Such insurance shall cover: ○ all structure(s) under construction, including retaining walls, paved surfaces and roadways, bridges, glass, foundation(s), footings, underground pipes and wiring, excavations, grading, backfilling or filling; ○ all temporary structures (e.g., fencing, scaffolding, cribbing, false work, forms, site lighting, temporary utilities and buildings)

	o Agreed Value	Included	located at the site;
	o Damage arising from error, omission or deficiency in construction methods, design, specifications, workmanship or materials, including collapse	Included	o all property including materials and supplies on site for installation;
	o Debris removal additional limit	\$1,000,000	o all property including materials and supplies at other locations but intended for use at the site;
	o Earthquake and Earthquake Sprinkler Leakage	\$5,000,000	o all property including materials and supplies in transit to the site for installation by all means of transportation other than ocean transit; and
	o Flood	\$5,000,000	o other Work at the site identified in the Agreement to which this Exhibit is attached.
	o Freezing	Included	• No protective safeguard warranty shall be permitted.
	o Mechanical breakdown including hot & cold testing	Included	• The termination of coverage provision shall be endorsed to permit occupancy of the covered property being constructed. This insurance shall be maintained in effect, unless otherwise provided for the Agreement Documents, until the earliest of:
	o Ordinance or law	\$1,000,000	o the date on which all persons and organizations who are insureds under the policy agree that it shall be terminated;
	o Pollutant clean-up and removal	\$ 25,000	o occupancy, in whole or in part;
	o Preservation of property	Included	o the date on which release of substantial completion is executed; or
	o Theft	Included	o the date on which the insurable interests of Contractor in the Covered Property has ceased.
	• Deductible shall not exceed		• A waiver of subrogation provision shall be provided in favor of all insureds.
	o All Risks of Direct Damage, Per Occurrence, except	\$10,000	
	o Named Storm	2% subject to \$50,000 minimum	
	o Earthquake and Earthquake Sprinkler Leakage, Per Occurrence	\$100,000	
	o Flood, Per Occurrence or excess of NFIP if in Flood Zone A or V	\$100,000	

2. **General Insurance Requirements**

A. **Definitions.** For purposes of this Agreement:

- i. "ISO" means Insurance Services Office.
- ii. "Contractor" shall include subcontractors of any tier.
- iii. "Owner Parties" means (a) the City of Deer Park ("Owner"), (b) the Project, (c) any lender whose loan is secured by a lien against the Work, (d) their respective shareholders, members, partners, joint venturers, affiliates, subsidiaries, successors and assigns, (e) any directors, officers, employees, or agents of such persons or entities, and (f) others as required by the Construction Documents.

B. **Policies.**

- i. Contractor shall maintain such General Liability, Excess Liability, Professional and Pollution insurance in identical coverage, form and amount, including required endorsements, for at least two (2) years following Date of Substantial Completion of the Work to be performed under this Agreement. Contractor shall provide written representation to Owner stating Work completion date.
- ii. All policies must:
 - a. Be written through insurance companies authorized to do business in the State in which the work is to be performed and rated no less than A-: VII in the most current edition of A. M. Best's Key Rating Guide at all times Work is to be performed.

- b. Provide a waiver of subrogation in favor of Owner Parties on all insurance coverage carried by Contractor, whether required herein or not.
- c. Contain an endorsement providing for thirty (30) days prior written notice of cancellation to Owner.
- d. Be provided to the Owner Parties in compliance with the requirements herein and shall contain no endorsements that restrict, limit, or exclude coverage required herein in any manner without the prior express written approval of the Owner.
- iii. Failure of any Owner Party to demand such certificate or other evidence of full compliance with these insurance requirements or failure of any Owner Party to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain such insurance.
- iv. Contractor shall provide to the Owner a certified copy of all insurance policies required herein within ten (10) days of any such request. Renewal policies, if necessary, shall be delivered to the Owner prior to the expiration of the previous policy.
- v. Commencement of Work without provision of the required certificate of insurance, evidence of insurance and/or required endorsements, or without compliance with any other provision of this Agreement, shall not constitute a waiver by any Owner Party of any rights. The Owner shall have the right, but not the obligation, of prohibiting the Contractor or any subcontractor from performing any Work until such certificate of insurance, evidence of insurance and/or required endorsements are received and approved by the Owner.

C. Limits, Deductibles and Retentions

- i. The limits of liability may be provided by a single policy of insurance or by a combination of primary and excess policies, but in no event shall the total limits of liability available for any one occurrence or accident be less than the amount required herein.
- ii. No deductible or self-insured retention shall exceed \$25,000 without prior written approval of the Owner, except as otherwise specified herein. All deductibles and/or retentions shall be paid by, assumed by, for the account of, and at the Contractor's sole risk. The Contractor shall not be reimbursed for same

D. Forms

- i. If the forms of policies, endorsements, certificates or evidence of insurance required by this Exhibit are superseded or discontinued, Owner will have the right to require other equivalent forms.
- ii. Any policy or endorsement form other than a form specified in this Exhibit must be approved in advance by Owner.

E. Evidence of Insurance. Insurance must be evidenced as follows:

- i. ACORD Form 25 Certificate of Liability Insurance for liability coverages.
- ii. ACORD Form 28 Evidence of Commercial Property Insurance for property coverages.
- iii. Evidence shall be provided to Owner prior to commencing Work and prior to the expiration of any required coverage.
- iv. ACORD Forms specify:
 - a. Owner as certificate holder at Owner's mailing address;
 - b. Insured's name, which must match that on this Agreement;
 - c. Insurance companies producing each coverage and the policy number and policy date of each coverage;
 - d. Producer of the certificate with correct address and phone number and have the signature of the authorized representative of the producer;
 - e. Additional Insured status in favor of Owner Parties;
 - f. Amount of any deductible or self-insured retention in excess of \$25,000;
 - g. Designated Construction Project(s) General Aggregate Limit;
 - h. Primary and non-contributory status;
 - i. Waivers of subrogation; and
 - j. All exclusions and limitations added by endorsement to the General Liability coverage. This can be achieved by attachment of the Schedule of Forms and Endorsements page.
- v. Copies of the following shall also be provided:
 - a. General Liability Additional insured endorsement(s);
 - b. General Liability Schedule of Forms and Endorsements page(s); and
 - c. 30 Day Notice of Cancellation endorsement applicable to all required policies.

F. Contractor Insurance Representations to Owner Parties

- i. It is expressly understood and agreed that the insurance coverages required herein (a) represent Owner Parties' minimum requirements and are not to be construed to void or limit the Contractor's indemnity obligations as contained in this Agreement nor represent in any manner a determination of the insurance coverages the Contractor should or should not maintain for its own protection; and (b) are being, or have been, obtained by the Contractor in support of the Contractor's liability and indemnity obligations under this Agreement. Irrespective of the requirements as to insurance to be carried as provided for herein, the insolvency, bankruptcy or failure of any insurance company carrying insurance of the Contractor, or the failure of any insurance company to pay claims accruing, shall not be held to affect, negate or waive any of the provisions of this Agreement.
- ii. Failure to obtain and maintain the required insurance shall constitute a material breach of, and default under, this Agreement. If the Contractor shall fail to remedy such breach within five (5) business days after notice by the Owner, the Contractor will be liable for any and all costs, liabilities, damages and penalties resulting to the Owner Parties from such breach, unless a written waiver of the specific insurance requirement(s) is provided to the Contractor by the Owner. In the event of any failure by the Contractor to comply with the provisions of this Agreement, the Owner may, without in any way compromising or waiving any right or remedy at law or in equity, on notice to the Contractor, purchase such insurance, at the Contractor's expense, provided that the Owner shall have no obligation to do so and if the Owner shall do so, the Contractor shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages.
- iii. This Exhibit is an independent contract provision and shall survive the termination or expiration of the Construction Agreement.

G. Insurance Requirements of Contractor's Subcontractors

- i. Insurance similar to that required of the Contractor shall be provided by all subcontractors (or provided by the Contractor on behalf of subcontractors) to cover operations performed under any subcontract agreement. The Contractor shall be held responsible for any modification in these insurance requirements as they apply to subcontractors. The Contractor shall maintain certificates of insurance from all subcontractors containing provisions similar to those listed herein (modified to recognize that the certificate is from subcontractor) enumerating, among other things, the waivers of subrogation, additional insured status, and primary liability as required herein, and make them available to the Owner upon request.
- ii. The Contractor is fully responsible for loss and damage to its property on the site, including tools and equipment, and shall take necessary precautions to prevent damage to or vandalism, theft, burglary, pilferage and unexplained disappearance of property. Any insurance covering the Contractor's or its subcontractor's property shall be the Contractor's and its subcontractor's sole and complete means or recovery for any such loss. To the extent any loss is not covered by said insurance or subject to any deductible or co-insurance, the Contractor shall not be reimbursed for same. Should the Contractor or its subcontractors choose to self insure this risk, it is expressly agreed that the Contractor hereby waives, and shall cause its subcontractors to waive, any claim for damage or loss to said property in favor of the Owner Parties.

H. Use of the Owners Equipment

The Contractor, its agents, employees, subcontractors or suppliers shall use the Owners equipment only with express written permission of the Owners designated representative and in accordance with the Owners terms and condition for such use. If the Contractor or any of its agents, employees, subcontractors or suppliers utilize any of the Owners equipment for any purpose, including machinery, tools, scaffolding, hoists, lifts or similar items owned, leased or under the control of the Owner, the Contractor shall defend, indemnify and be liable to the Owner Parties for any and all loss or damage which may arise from such use.

I. Release and Waiver

The Contractor hereby releases, and shall cause its subcontractors to release, the Owner Parties from any and all claims or causes of action whatsoever which the Contractor and/or its subcontractors might otherwise now or hereafter possess resulting in or from or in any way connected with any loss covered by insurance, whether required herein or not, or which should have been covered by insurance required herein, including the deductible and/or uninsured portion thereof,

maintained and/or required to be maintained by the Contractor and/or its subcontractors pursuant to this Agreement. **THE FOREGOING RELEASE AND WAIVER APPLY EVEN IF THE LOSS OR DAMAGE IS CAUSED IN WHOLE OR IN PART BY THE FAULT OR NEGLIGENCE OR STRICT LIABILITY OF THE OWNER PARTIES.**

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, _____, as Principal herein, and [Surety], a corporation organized and existing under the laws of the State of [Surety's state of incorp] and who is authorized and admitted to issue surety bonds in the State of Texas, as surety, are held and firmly bound unto the City of Deer Park, Texas, a municipal corporation with its principal location of 710 E. San Augustine, Deer Park, Texas, Harris County, Obligee herein, in the sum of [printed amount of bond] Dollars (\$[numeric amount of bond]) for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has entered into a certain written contract with the Obligee dated the ____ day of _____, 20____, herein referred to as "the Contract" and incorporated herein and made a part hereof for all purposes, for the construction of the following project: [project name].

NOW, THEREFORE, the condition of this obligation is such, if the said Principal shall faithfully perform the work in accordance with the plans, specifications, and other Contract Documents and shall fully indemnify and hold harmless the Obligee from all costs and damages which Obligee may suffer by reason of Principal's failure to perform the Work in conformity with the Contract Documents, and reimburse and repay Obligee for all outlay and expense that Obligee may incur in making good such default, then this obligation shall be void; otherwise, to remain in full force and effect. Whenever Contractor shall be declared by Obligee to be in default under the Contract, the Surety shall, upon request of Obligee and within seven (7) calendar days from receipt of Obligee's notice of Contractor's default, commence and thereafter complete performance of Contractor's obligations under the Contract. This Bond covers all contractual obligations of Contractor under the Contract, including, without limitation, the indemnity, warranty and guaranty obligations. The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of any of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto. The penal limit of this bond shall

automatically be increased by the amount of any change order, supplemental agreement or amendment which increases the price of the Contract.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of such statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20__.

The date of bond shall not be prior to date of Contract.

ATTEST:

(Principal) Secretary

(S E A L)

Witness as to Principal

ATTEST:

Secretary

(S E A L)

Witness as to Surety

PRINCIPAL

By: _____

Name: _____

Title: _____

Address: _____

Telephone Number: _____

SURETY

By: _____

Name: _____
Attorney in Fact

Address: _____

Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

City of Deer Park
710 E. San Augustine
Deer Park, Texas 77536

By: _____

Title: _____

Date: _____

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, _____, as Principal herein, and [Surety], a corporation organized and existing under the laws of the State of [Surety's state of incorp] and who is authorized and admitted to issue surety bonds in the State of Texas, as surety, are held and firmly bound unto the City of Deer Park, Texas, a municipal corporation with its principal location of 710 E. San Augustine, Deer Park, Texas, Harris County, Obligee herein, in the sum of [printed amount of bond] Dollars (\$[numeric amount of bond]) for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, Principal has entered into a certain written contract with the Obligee dated the ____ day of _____, 20____, which contract is hereby referred to herein as "the Contract" and is incorporated herein to the same extent as if copied at length, for the following project: [project name].

NOW, THEREFORE, the condition of this obligation is such, that if the said Principal shall directly or indirectly timely make payment to each and every claimant (as defined in Chapter 2253, Texas Government Code, as amended) supplying labor or materials in the prosecution of the work under the Contract, then this obligation shall be void; otherwise, to remain in full force and effect. *This obligation may be enforced by the Obligee in the event of bankruptcy or default by Principal in payments to suppliers of labor or materials in the prosecution of the work under the Contract, in either of which events the Surety shall make such payments as Principal has failed to pay and as may be required to complete the work under the contract.* The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of said statute, to the same extent as if it were

copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20____.

The date of bond shall not be prior to date of Contract.

ATTEST:

(Principal) Secretary

(S E A L)

Witness as to Principal

PRINCIPAL

By: _____

Name: _____

Title: _____

Address: _____

Telephone Number: _____

ATTEST:

Secretary

(S E A L)

Witness as to Surety

SURETY

By: _____

Name: _____
Attorney in Fact

Address: _____

Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

City of Deer Park
710 E. San Augustine
Deer Park, Texas 77536

By: _____

Title: _____

Date: _____

STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR

This Agreement is made and entered into as of the ____ day of _____, 2017 by and between the:

“OWNER”

The City of Deer Park
710 E. San Augustine
Deer Park, Texas 77536
281.479.2394 t
281.478.7217 f

and

“CONTRACTOR”

[name of Contractor]
[address]
[phone and fax numbers]

for the following Project:

[project name]

The **ENGINEER** for the Project is

[name of engineer]
[address]
[phone and fax numbers]

1.0 THE WORK OF THIS CONTRACT

Unless otherwise provided in these Contract Documents, the CONTRACTOR shall be responsible for performing or causing to be performed all Work including labor and materials, necessary to build, construct, erect and equip in accordance with the Contract Documents and at its own proper cost and expenses to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said construction, in accordance with the conditions and prices stated in the Proposal attached hereto.

The Contract Documents for this Project include this Standard Form of Agreement and the following documents, if applicable:

- Addenda issued by ARCHITECT
- General Conditions
- Performance and Payment Bonds
- Request For Proposal and Contract Forms
- Bid Forms
- Technical Specifications
- Drawings

2.0 CONTRACT TIME AND COMPLETION

§ 2.1 The date of commencement of the Work shall be stated in a Notice to Proceed issued by the OWNER.

§ 2.2 Contract Time

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

§2.2.2 Time is of the essence in all phases of the Work. Additionally, time limits and periods of time stated in the Contract Documents are of the essence. It is specifically understood and agreed to by and between OWNER and CONTRACTOR that time is of the essence in the Final Completion of the Work, and that failure to finally complete the Work within the designated period, or as it may be extended, shall be construed as a breach of this Agreement.

§ 2.3 Final Completion

The CONTRACTOR shall achieve Final Completion of the entire Work not later than [insert days to complete] calendar days from the date of commencement, subject to and adjustments of this Contract Time as provided in the Contract Documents and Changer Orders modifying and extending this Agreement.

§ 2.4 Liquidated Damages

The CONTRACTOR acknowledges and recognizes that the OWNER is entitled to full and beneficial occupancy and use of the completed work following expiration of the Contract Time. The CONTRACTOR further acknowledges and agrees that, if the CONTRACTOR fails to achieve the Final Completion of any portion of the Work within the Contract time, the OWNER will sustain actual damages as a result of such failure. The exact amount of such damages will be difficult to ascertain. Therefore, the OWNER and CONTRACTOR agree that, if the CONTRACTOR shall neglect, fail, or refuse to achieve Final Completion of the Work by the Final Completion date, subject to proper extension granted by the OWNER, then the CONTRACTOR agrees to pay the OWNER the sum of

[insert written amount] ([insert numerical amount])

for each day in which such Work is not completed, not as penalty, but as liquidated damages, for the damages (“Liquidated Damages”) that would be suffered by OWNER as a result of delay for each and every calendar day that the CONTRACTOR shall have failed to have completed the Work as required herein. The Liquidated Damages shall be in lieu of any and all other damages which may be incurred by OWNER as a result of the failure of CONTRACTOR to complete within the Contract Time.

§ 2.5 FINAL COMPLETION

§ 2.5.1 Timely Final Completion is an essential condition of this contract. CONTRACTOR agrees to achieve Final Completion by the designated or extended Final Completion date. The date of Final Completion shall be fixed by this Agreement, unless modified by Change Order, and memorialized by a letter of Final Acceptance as provided in the General Conditions to this Agreement.

§ 2.5.2 Final Completion means actual completion of the Work, including any extras or Change Orders reasonably required or contemplated under the Contract Documents other than warranty work that may be required pursuant to the Contract Documents.

§ 2.5.3 CONTRACTOR’s general warranty period and guarantee will begin to run upon Final Completion as approved by OWNER, and following issuance of ENGINEER’s letter of Final Acceptance.

3.0 CONTRACT SUM

§ 3.1 The OWNER shall pay the CONTRACTOR the Contract Sum in current funds for the CONTRACTOR’s performance of the Contract. The Contract Sum shall be [insert written total] ([insert numerical total]) subject to additions and deductions as provided in the Contract Documents.

§ 3.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the OWNER:

[alternate __, if any]
[alternate __, if any]

§ 3.3 Unit prices, if any:

[insert any unit price items and descriptions] [or add reference to Proposal with unit prices and estimated quantities]

Item	Units and Limitations	Price Per Unit (\$0.00)
[unit price item]	[unit]	[price]

4.0 PAYMENT

§ 4.1 APPLICATIONS FOR PAYMENT

Each Application for Payment shall be based on the most recent schedule of values submitted by the CONTRACTOR in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Amount among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the ENGINEER and OWNER may require. This schedule, unless objected to by the ENGINEER or OWNER, shall be used as a basis for reviewing the CONTRACTOR's Applications for Payment.

§ 4.1.1 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. Unless otherwise noted, application for payment shall be done on a monthly basis.

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

- .1** Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of «Five» percent («5.00» %). Pending final determination of cost to the OWNER of changes in the Work, amounts not in dispute shall be included;
- .2** Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the OWNER, suitably stored off the site at a location agreed upon in writing), less retainage of «Five» percent («5.00» %);
- .3** Subtract the aggregate of previous payments made by the OWNER; and

- .4 Subtract amounts, if any, for which the ENGINEER has withheld or nullified a Certificate for Payment.

§ 4.1.3 If the total Contract Sum at the time of execution of this Agreement is less than \$400,000.00, the OWNER may elect to withhold retainage of ten percent (10%) from each progress payment in lieu of the retainage amounts set forth in Section 4.1.2.

§ 4.1.4 Reduction or limitation of retainage, if any, shall be as follows: Reduction or limitation of retainage shall be at the OWNER's sole discretion.

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

§ 4.2 FINAL PAYMENT

§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the OWNER to the CONTRACTOR when

- .1 the CONTRACTOR has fully performed the Contract except for the CONTRACTOR's responsibility to correct Work as provided in the General Conditions, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a letter of Final Acceptance has been issued by the ENGINEER and accepted by the OWNER.

§ 4.2.2 The OWNER's final payment to the CONTRACTOR shall be made no later than 30 days after the Work has been completed and accepted by the OWNER, in writing, following the issuance of the ENGINEER's final Certificate for Payment:

This Agreement is entered into as of the day and year written above ("The Date of Execution"):

OWNER

CONTRACTOR

By: _____
Title: _____

By: _____
Title: _____

SECTION 00020

INVITATION TO BID

Sealed bids will be received by the **City of Deer Park** in the **Deer Park City Hall, City Secretary, at 710 E. San Augustine Street, Deer Park, Texas 77536** on **Tuesday, May 16, 2017 at 2:00 p.m.** and immediately thereafter publicly opened and read, for constructing the following project:

DEER PARK SPORTS FIELDS – PROJECTS A & B

Bid Number: _____

The project consists of furnishing and installing and providing all labor and materials required for park entry features, concession/restroom facilities, roadways, parking, utilities, soccer fields, softball fields, sports field lighting, parking area lighting, and miscellaneous items, as more fully described in the Drawings and the summary of work contained in Section 00300.

Bids must be submitted on the complete project. Bids must be enclosed in a sealed envelope, addressed to **City of Deer Park, ATTN: Contract Coordinator, 710 E. San Augustine Street, Deer Park, Texas 77536** and the outside of the envelope must be marked **DEER PARK SPORTS FIELDS – PROJECTS A & B**. All bids must be made on blank forms provided and included in the bound document. The name, address, and license number of the Bidder must be plainly marked thereon.

Bidding Documents may be examined and obtained from www.CivcastUSA.com: search TITLE NAME. Bidders must register on this website in order to view and/or download solicitation documents for this project. There is NO charge to view or download documents. Addenda are only available at the above site. It is the Bidder's responsibility to check the site for the issuance of any addenda. For information concerning the project, contact Kolby Davidson, PLA with Halff Associates, Inc. at (713) 588-2466. All bid submittals must comply with requirements set out in the Contract Documents or will be considered non-responsive. Bids not accompanied by cashier's check or bid bond will not be considered. **Bidders should register on the City of Deer Park Ebid web site – <https://purchasing.georgetown.org/bid-information/>** The date, time and place for the pre-bid conference, if to be held, are specified below and in Section 00100, Instructions to Bidders.

Each bid must be accompanied by cash or a certified cashier's check, drawn on a bank or trust company authorized to do business in the State of Texas, payable to the City of Deer Park in an amount at least equal to five percent (5%) of the total amount of the bid, as a guarantee that a contract will be entered into. In lieu of cash or a certified check, the Bidder may submit a bid bond in the form prescribed in the Instructions to Bidders.

Performance and Payment Bonds, when required, shall be executed on forms furnished by OWNER. Each bond shall be issued in an amount of one hundred percent (100%) of the Contract Amount by a solvent surety or insurance company licensed to do business in the State of Texas and as specifically prescribed in the General Conditions and Supplemental Conditions. Minimum insurance requirements are specified in the General Conditions and Supplemental Conditions. The successful Bidder and its subcontractors shall pay to laborers, workmen, and mechanics the prevailing wage rates as required by the Supplemental Conditions.

The right is reserved to reject any or all bids, to waive minor technicalities, and to award a contract or contracts which, in the opinion of the Owner, appear to be in its best interest. A minor technicality is one that does not affect the competitiveness of the Bid. The Owner reserves the right to hold any or all proposals for the period of time from the opening of bids as specified in Section 00300, Bid Form.

Effective January 1, 2016, Texas Government Code Section 2252.908 requires persons who enter into contract with a government entity to submit a disclosure of interested parties (Form 1295) to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The law applies only to a contract of a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least \$1 million.

Use the following link to access filing instructions:

https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

Publication Dates:

PUBLICATION SOURCE:

Wednesday, April 12, 2017

Wednesday, April 19, 2017

SECTION 00100

INSTRUCTIONS TO BIDDERS

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. *Bidder*--The individual or entity who submits a Bid directly to OWNER.
 - B. *Issuing Office*--The office from which the Bidding Documents are to be issued.
 - C. *Successful Bidder*--The Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

ARTICLE 2: COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents in the number and for the non-refundable deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Issuing Office.
- 2.02 Complete sets of Bidding Documents 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.
- 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, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below.
- A. Section 00400 Statement of Bidder's Experience, including Attachments A – I.

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 ENGINEER to any Bidder 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 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 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 will 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.
- 4.06 DELETED
- 4.07 In submitting this Bid, the Bidder represents that:
- A. Bidder has examined and carefully studied the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;
 - 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, or performance of the Work;
 - D. Bidder has carefully studied (1) all 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) 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. Bidder has obtained and carefully studied (or accepts the consequences and responsibility 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 any 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 its 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 the 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 promptly given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirmed that the written resolution thereof by ENGINEER is acceptable to Bidder; and
 - 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.
- 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 on _____, _____, 2017, at 10:00 a.m. at the Community Center, 710 E. San Augustine Street, Deer Park, Texas 77536. The project site will be available for inspection by prospective bidders immediately following the pre-bid conference.

- Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders must attend 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.

ARTICLE 6: SITE AND OTHER AREAS

6.01 The Site is identified 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. 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.

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 five percent (5%) of Bidder's maximum Bid price and in the form of a certified or bank check or a Bid Bond [on the form attached] 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 61 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: NOT USED

ARTICLE 10: NOT USED

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. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions and may be supplemented in the General Requirements.

ARTICLE 12: SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 Bidder shall identify the major Subcontractors Bidder proposes for this Project in Section 00400 Statement of Bidder's Experience. 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 as provided on Attachment E of Statement of Bidder's Experience. 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.

- 12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to another 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 CONTRACTOR shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom CONTRACTOR has reasonable objection.

ARTICLE 13: PREPARATION OF BID

- 13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained from 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 [section, 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 acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid form.
- 13.10 The address, telephone number, and email address 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 Texas or covenant to obtain such qualification prior to award of the Contract. Bidder's Texas state contractor license number for, 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 11.04 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 11.03 of the General Conditions.
- 14.03 As provided by Texas Local Government Code § 252.043(d), the Contract shall be awarded to the lowest responsible Bidder.

ARTICLE 15: SUBMITTAL OF BID

- 15.01 Each prospective Bidder is furnished one separate unbound copy each of the Bid form, and, if required, the Bid Bond form. The unbound copy of the Bid form shall be completed and **one original and one copy** shall be submitted with the Bid bond or security and the following data:
- A. **Section 00400 Statement of Bidder's Experience, including Attachments A – I.**
- 15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the Bid Number, 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 or hand delivered Bid shall be addressed to:

**City of Deer Park
ATTN: City Secretary
710 E. San Augustine Street
Deer Park, Texas 77536**

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 or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders 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 As permitted by the Texas Local Government Code § 252.043, 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, to be non-responsible. OWNER may 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. OWNER reserves the right to waive minor technicalities and make an award to best serve the interest of the OWNER.
- 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 Section 00400 Statement of Bidder's Experience.
- 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 If the Contract is to be awarded, OWNER will award the Contract to the lowest responsible Bidder.
- 19.07 No Contract will be awarded or binding upon OWNER until it has been signed by its Mayor (or by the Mayor Pro Tem or other Council members stated in the City Charter) after having been duly authorized to do so by the City Council of the City of Deer Park.
- 19.08. Chapter 176 of the Texas Local Government Code requires a person or agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with a local governmental entity to submit a **Conflict of Interest Questionnaire** to the appropriate records administrator of the City not later than the seventh business day after the date the person begins contract discussions or negotiations with the local governmental entity, or submits to the local governmental entity an application, response to a request for proposals or Bids, correspondence, or another writing related to a potential agreement with the local governmental entity. For purposes of this Bid, Bidder may submit the completed form with the Bid. Each Bidder is responsible for verifying it is using the most current form available from www.ethics.state.tx.us. This legislation is subject to change, and each vendor should consult their own attorney regarding the current law. This statement is provided for information purposes only, and submission of a completed Conflict of Interest Questionnaire is not a required element of the Bid.
- 19.09 Section 2252.908 of the Texas Government Code states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The law applies only to a contract of a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least \$1 million.

All contractors entering into a contract that is approved by City Council must complete a Form 1295.

A business entity must enter the required information on Form 1295 online at https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm and print a copy of the completed form, which will include a certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 with the certification of filing must be submitted to the City.

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 must be accompanied by such Bonds.
- 20.02 The CONTRACTOR shall not commence Work until he has furnished certification of all insurance required and such has been approved by the City of Deer Park, nor shall the CONTRACTOR allow any subcontractor to commence Work until proof of all similar insurance that is required of the Subcontractor has been furnished and approved. The OWNER must be an additional insured on the policies and the policies must provide coverage to OWNER for work under this Contract. A certificate of insurance that contains the following language, or similar language, **WILL NOT BE ACCEPTED** as evidence that OWNER is an additional insured and covered under the policies: "ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND, OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW." The Certificate of Liability Insurance form included in the Bid Documents must be used by the CONTRACTOR's Insurer, and CONTRACTOR's Insurer must furnish a full and complete copy of the underlying insurance policy to the OWNER upon OWNER's request to establish proof of insurance.
- 20.03 If the Bidder's insurance company is authorized, pursuant to its agreement with Bidder, to arrange for the replacement of a loss, rather than by making a cash payment directly to the City of Deer Park, the insurance company must furnish or have furnished by Bidder, a performance bond in accordance with Chapter 2253.021(b), Texas Government Code, and a payment bond in accordance with Chapter 2253.021(c), Texas Government Code.

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.

ARTICLE 22: SALES AND USE TAXES

- 22.01 OWNER is exempt from Texas state sales and use taxes on materials and equipment to be incorporated in the Work, pursuant to the provisions of Section 151.309(5) of the

Texas Tax Code. Said taxes shall not be included in the Bid. Refer to paragraph 6.10 of the General Conditions for additional information.

ARTICLE 23: RETAINAGE

23.01 Under paragraph 14.02 of the General Conditions, retainage in the amount of five percent (5%) will be withheld pursuant to Texas Government Code § 2253, and such retainage will be withheld until thirty (30) days after Final Completion.

END OF SECTION 00100

SECTION 00300

BID FORM

BIDDER'S NAME _____

PROJECT IDENTIFICATION:

City of Deer Park

Project 'A': Soccer Field Development - Phase 1
Project Location: East Blvd. and East 13th St., Deer Park, Texas.

Project 'B': Girls Softball Renovations
Project Location: 407 West X St., Deer Park, Texas.

BID NUMBER:

THIS BID IS SUBMITTED TO:

**The City of Deer Park, Texas
City Secretary at City Hall
710 E. San Augustine Street
Deer Park, Texas 77536**

- 1.01** 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.
- 1.02** BIDDER understands and agrees that the OWNER has the right to reject any or all Bids and to waive any minor technicalities.
- 2.01** Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of OWNER.
- 3.01** In submitting this Bid, Bidder represents, as set forth in the Agreement, 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 all 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 carefully studied 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, and (2) reports and drawings of a Hazardous Environmental Condition, if any, which has been identified in the Supplementary.
- E. Bidder has obtained and carefully studied (or assumes responsibility for having done 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.

4.01 Bidder further represents that 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; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

5.01 Bidder will complete the Work in accordance with the Contract Documents for the prices attached hereto as Attachment A - Unit Price Schedule

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 provided, determined as provided in the Contract Documents.

6.01 Bidder agrees that the Work will be substantially complete within 150 calendar days after the date of the written Notice-to-Proceed and to fully complete project and ready for final payment within 180 calendar days after the date of the written Notice to Proceed.

Both Project A and Project B will be constructed concurrently.

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

- A. Required Bid security in the form of _____;
- B. Section 00400, Statement of Bidder's Experience, including Attachments A – I.

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.

SUBMITTED on _____, 20____.

If Bidder is:

An Individual

Name (typed or printed): _____

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

Doing business as: _____

Business address: _____

Phone No.: _____ FAX No.: _____

A Partnership

Partnership Name: _____ (SEAL)

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

Name (typed or printed): _____

Business address: _____

Phone No.: _____ FAX No.: _____

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)

Business address: _____

Phone No.: _____ FAX No.: _____

Date of Qualification to do business is _____.

A Joint Venture

Joint Venturer Name: _____ (SEAL)

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

Name (typed or printed): _____

Title: _____

Business address: _____

Phone No.: _____ FAX No.: _____

Joint Venturer Name: _____ (SEAL)

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

Name (typed or printed): _____

Title: _____

Business address: _____

Phone No.: _____ FAX No.: _____

Phone and FAX Number, and Address for receipt of official communications:

(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.)

DEER PARK SPORTS FIELDS
PROJECT A: SOCCER FIELD DEVELOPMENT (PHASE 1)

Attachment A
UNIT PRICE SCHEDULE



Item No.	Quantity	Unit	Description (with unit price in words)	Unit Price	Total Price
SCHEDULE NO. 100 - GENERAL SITE					
SITEWORK					
100.00	13,319	CY	Existing Soil Excavation		\$
100.01	47,040	CY	Import Soil, Placement and Compaction		\$
100.02	29	AC	Demolition, Clearing and Grubbing		\$
100.03	1	LS	Detention Ponds Allowance		\$
UTILITIES					
100.06	1	LS	12" Water Line Offset		\$
100.07	4,230	LF	Trench Safety Plan		\$
100.08	1	LS	8" Force Main Offset		\$
100.09	7	EA	Sanitary Sewer Manhole		\$
100.10	2,120	LF	6" PVC Sanitary Sewer		\$
100.11	1	EA	6" Sanitary Sewer Cleanout		\$
100.12	3	EA	2" Water Line Plug		\$
100.13	1	EA	6" Sanitary Sewer Plug		\$
100.14	352	LF	4" C-900 Water Line		\$
100.15	1	EA	4" TS&V		\$
100.16	321	LF	2" C-900 Water Line		\$
100.17	1	EA	2" Service Saddle		\$
100.18	4	EA	2" x 45 degree Bend, AB		\$
100.19	1	EA	2" x 90 degree Bend, AB		\$
100.20	1	EA	4" x 45 degree Bend, AB		\$
100.21	1	EA	4" x 2" Tee		\$
100.22	1	EA	4" x 2" Reducer		\$
100.23	2	EA	2" Domestic Water Meter		\$
100.24	1	EA	2" Irrigation Water Meter		\$
100.25	2	EA	2" Backflow Preventer (Domestic)		\$
100.26	1	EA	2" Backflow Preventer (Irrigation)		\$
100.27	110	LF	18" HDPE		\$
100.28	82	LF	30" HDPE		\$
100.29	254	LF	18" RCP		\$
100.30	48	LF	21" RCP		\$
100.31	758	LF	24" RCP		\$
100.32	185	LF	30" RCP		\$
100.33	8	EA	Type "A" Grate Inlet		\$
100.34	1	EA	Type "E" Area Inlet		\$
100.35	2	EA	Typ "C" Manhole		\$
100.36	1	EA	PARK USA Floatables Collection Screen Assembly Model #DSHD-24-3		\$
100.37	1	LS	Erosion Control Allowance		\$
100.38	1	LS	Electric Primary Allowance		\$
Site Electrical					
100.39	1	LS	Primary Site Electric Service (Does NOT include PEC fee's)		\$
100.40	1	LS	Secondary Site Electric (All site electric to within 5 ft. of buildings)		\$
100.41	9	EA	Lighting (RAB Lighting; pole, single head fixture, LED high wattage type II		\$
100.42	1	LS	Soccer Field Lighting (Musco Lighting)		\$
SUBTOTAL SCHEDULE NO. 100:					\$

SCHEDULE NO. 200 - PARKING AND MAINTENANCE AREA IMPROVEMENTS					
Parking Improvements					
200.00	4,160	SY	Paving Stalls (Reinforced 5" Concrete)		\$
200.01	6,050	SY	Paving Aisles (Reinforced 6" Concrete)		\$
200.02	255	SY	Driveway Apron (Reinforced 7" Concrete)		\$
200.03	67	EA	Wheel stops		\$
200.04	1	LS	Striping & Signage Allowance		\$
200.05	7	EA	Bollard Allowance		\$
200.06	1	LS	Entry Swing Gate		\$
Maintenance Area					
200.08	5,700	SF	Maintenance access drive & layout area (6" reinf. conc.)		\$
200.09	380	LS	8 ft. ht. black vinyl coat chainlink, gates		\$
SUBTOTAL SCHEDULE NO. 200:					\$

SCHEDULE NO. 300 - SITE HARDSCAPE				
300.00	150	LF	Seatwalls: CMU Blocks (18" wide x 18" ht)	\$
300.01	3,700	SF	Concrete Plaza at Restroom/Concession Bldg. (6" reinf conc.)	\$
300.02	4,800	SF	Concrete Walkways (4" reinf conc.)	\$
300.03	3,200	SF	Concrete Walkways (6" reinf conc.)	\$
300.04	4,000	SF	Concrete Pad for Bleachers (5" thick reinf. conc.)	\$
300.05	230	SF	Concrete Pad for Dumpsters (7" thick reinf. conc.)	\$
300.06	1	EA	Dumpster Enclosure (Fence, Gates, Bollards)	\$
300.07	650	LF	Barrier Post & Cable Fence	\$
300.08	140	SF	Detectable Warning - Surface Mat	\$
300.09	80	LF	8 ft. ht. black vinyl coat chainlink, gates	\$
Signage				
300.10	1	EA	Monument - Primary Sign	\$
SUBTOTAL SCHEDULE NO. 300:				\$

SCHEDULE NO. 400 - REVEG / LANDSCAPE / IRRIGATION				
400.00	1	LS	Irrigation	\$
400.01	6,930	CY	Topsoil, import and place (4" depth at field areas)	\$
400.02	51,000	SY	Hydromulch (Common Bermuda)	\$
400.03	63,000	SY	Grass Sprigging ('TIF 419')	\$
SUBTOTAL SCHEDULE NO. 400:				\$

SCHEDULE NO. 400 - CONCESSION BUILDING				
500.00	1	LS	Restroom/Concession Bldg.	\$
SUBTOTAL SCHEDULE NO. 500:				\$

SCHEDULE NO. 500 - MISCELLANEOUS				
600.00	1	LS	Mobilization/General Requirements of Contract	\$
600.01	1	LS	De-mobilization/General Requirements of Contract	\$
600.02	1	LS	Compliance with SWPPP	\$
SUBTOTAL SCHEDULE NO. 600:				\$

TOTAL BASE BID SCHEDULES NO. 100 THROUGH 600: \$

Alt. #	Type	Description	
A1	ADD ALT	Install solid sod for field turfgrass in lieu of sprigging.	\$
A2	ADD ALT	Turn-key construction of Soccer Fields 5 and 6 is included as an Add Alternative Bid. Items to include clearing, grubbing, grading, irrigation system, sprigging to create game fields.	\$
A3	DEDUCT ALT	Deduct bleacher shade structures.	\$
A4	DEDUCT ALT	Deduct bleachers.	\$
A5	DEDUCT ALT	Deduct team benches.	\$
A6	ADD ALT	Add 136 wheel stops along at interior parking spaces.	\$

DEER PARK SPORTS FIELDS
PROJECT B: GIRLS SOFTBALL RENOVATION



Attachment A
UNIT PRICE SCHEDULE

Item No.	Quantity	Unit	Description (with unit price in words)	Unit Price	Total Price
SCHEDULE NO. 100 - GENERAL SITE					
SITEWORK					
100.00	4,500	SY	Remove Concrete Sidewalk/Paving	\$	
100.01	1	EA	Demo Restroom / Concession Building	\$	
100.02	2	EA	Demo Flag Poles	\$	
100.03	3	EA	Demo ICV	\$	
100.04	5	EA	Demo Misc Structures (bench, playground)	\$	
100.05	95	EA	Demo Light Poles	\$	
100.06	18	EA	Demo Trees	\$	
100.07	3,517	LF	Demo Fence	\$	
100.08	1	EA	Remove & Salvage Existing Fire Hydrant	\$	
100.09	2	EA	Remove Domestic Water Meter-Size Unknown	\$	
100.10	11,000	CY	Import, Spread & Compact	\$	
100.11	4,800	CY	Cut, spread and compact on-site	\$	
UTILITIES					
100.12	5	EA	Type "A" Grate Inlet	\$	
100.13	1	EA	Type "C" Storm Manhole	\$	
100.14	442	LF	18" HDPE	\$	
100.15	107	LF	24" HDPE	\$	
100.16	84	LF	30" HDPE	\$	
100.17	109	LF	18" RCP	\$	
100.18	1,390	LF	Trench Safety Plan	\$	
100.19	646	LF	2" C-900 DR 18 Pipe	\$	
100.20	2	EA	2" Water Line Plug	\$	
100.21	17	LF	6" C-900 DR 18 Fire Hydrant Lead	\$	
100.22	1	EA	2" x 45 degree Bend, AB	\$	
100.23	1	EA	2" x 2" Tee	\$	
100.24	1	EA	6" x 6" Tee	\$	
100.25	1	EA	6" x 2" Service Saddle	\$	
100.26	1	EA	2" Domestic Water Meter	\$	
100.27	1	EA	Fire Hydrant Assembly	\$	
100.28	2	LF	4" SCH 40 PVC Sanitary Sewer	\$	
100.29	1	LS	Electric Primary Allowance	\$	
Site Electrical					
100.30	1	LS	Primary Site Electric Service (Does NOT include PEC fee's)	\$	
100.31	1	LS	Secondary Site Electric (All site electric to within 5 ft. of buildings)	\$	
100.32	0	EA	Lighting (RAB Lighting: pole, single head fixture, LED high wattage type II	\$	
100.33	1	LS	Softball Field Lighting (Musco Lighting)	\$	
SUBTOTAL SCHEDULE NO. 100:					\$0.00
SCHEDULE NO. 200 - PARKING AND MAINTENANCE AREA IMPROVEMENTS					
Parking Improvements					
200.00	2,700	SY	Paving Stalls (Reinforced 5" Concrete)	\$	
200.01	4,800	SY	Paving Aisles (Reinforced 6" Concrete)	\$	
200.02	305	SY	Driveway Apron (Reinforced 7" Concrete)	\$	
200.03	2	LS	Entry Swing Gate	\$	
200.04	183	EA	Concrete Wheelstops	\$	
Maintenance Area					
200.05	2,800	SF	Maintenance Yard 8" Road Base	\$	
200.06	350	LF	Maintenance fence		
200.07	1	LS	24' x 30' Maintenance Building (turn-key)		
SUBTOTAL SCHEDULE NO. 200:					\$

SCHEDULE NO. 300 - SITE HARDSCAPE				
300.00	33,030	SF	Walkways Concrete 4" thick	\$
300.01	3,500	SF	Walkways (Heavy Duty Pavement for Fire Access) 6" thick	\$
300.02	6	EA	Bollards, removable	\$
300.03	1	EA	Entry Gates	\$
300.04	4	LS	Batting Cages - 4 Lane: slab, chainlink fencing, netting)	\$
300.05	5,260	SY	Skinned Infield (Clay with Turface)	\$
300.06	2,560	LF	8' Outfield and Foul Line w/ mow strip	\$
300.07	8	EA	12' Gates (6 ft. leaves)	\$
300.08	268	LF	25' Chainlink Backstop	\$
300.09	8	EA	Dugout (chainlink fencing, gate, bench w/ shelf, cover)	\$
300.10	4	EA	Scorekeeper Stand (table/bench/cover/electrical)	\$
300.11	1,350	LF	Scoreboard Conduit (from scorekeeper stand to board, Board by others)	\$
300.12	8	EA	Bleacher Area: (5 rows bleacher, 5" conc. pad, fabric shade structure)	\$
300.13	12	EA	Foul Poles	\$
300.14	880	LF	Trench Drain: concrete ribbon curb, catch basins, etc.	\$
Signage				
300.15	1	EA	Monument - Primary Sign	\$

SUBTOTAL SCHEDULE NO. 300: \$

SCHEDULE NO. 400 - REVEG / LANDSCAPE / IRRIGATION				
400.00	12,976	SY	Irrigation	\$
400.01	1,427	CY	Topsoil, import and place (4" depth at field areas)	\$
400.02	37,219	SY	Hydromulch - Common Bermuda	\$
400.03	12,976	SY	Grass Sprigging - 'TIF 419'	\$

SUBTOTAL SCHEDULE NO. 400: \$

SCHEDULE NO. 400 - CONCESSION BUILDING				
500.00	1	LS	Concession/Restroom: 2 unisex/Pad	

SUBTOTAL SCHEDULE NO. 500: \$

SCHEDULE NO. 500 - MISCELLANEOUS				
600.00	1	LS	Mobilization/General Requirements of Contract	\$
600.01	1	LS	De-mobilization/General Requirements of Contract	\$
600.02	1	LS	Compliance with SWPPP	\$

SUBTOTAL SCHEDULE NO. 600: \$

TOTAL BASE BID SCHEDULES NO. 100 THROUGH 600: \$

Alt. #	Type	Description	
B1	DEDUCT ALT	Remove 24'x30' Maintenance Building	\$
B2	ADD ALT	Upgrade Maintenance Building to 30'x50' size	\$
B3	ADD ALT	Extend water to maintenance building.	\$
B4	DEDUCT ALT	Deduct concrete mowstrips along perimeter of field fencing.	\$
B5	DEDUCT ALT	Deduct bleacher shade structures.	\$
B6	DEDUCT ALT	Install artificial turf with D.G. base at batting cages in lieu of infield clay material surface.	\$
B7	DEDUCT ALT	Deduct 64 wheel stops along outside edge of new parking area.	\$
B8	DEDUCT ALT	Deduct type 2 freestanding bleachers at Fields 4 and 5	\$
B9	ADD ALT	Install solid sod for field turfgrass in lieu of sprigging.	\$

SECTION 00400

STATEMENT OF BIDDERS EXPERIENCE

BIDDER'S NAME: _____

Project Name: DEER PARK SPORTS FIELDS – PROJECTS A & B

All questions on this form must be answered and data given must be clear and comprehensive. If necessary, questions may be continued on separately attached sheets.

PART 1, PART 2, and PART 3 below are to be submitted as part of the Bid.

PART 1 – GENERAL

- 1.1** Bidder must submit Attachments A through I contained in this Statement of Bidder's Experience form signed and notarized with its Bid. Failure to do so will constitute an incomplete Bid, which will be rejected. Information must be provided to the OWNER as part of the formal Bid. Submit the required forms in accordance with Article 10, Section 00100, Instructions to Bidders.
- 1.2** The Bidder and OWNER agree that, in determining the apparent low Bid, the responsibility of the Bidders will be considered in awarding a Contract for this Project. In connection therewith, all Bidders are required to submit a set of additional completed attachments to the Statement of Bidder's Experience Form for the OWNER's consideration. The Contract will be awarded by the OWNER to the lowest responsible Bidder. Submit the required forms in accordance with Article 10, Section 00100, Instructions to Bidders.
- 1.3** Bidder must perform a minimum of twenty percent (20%) of the contracted amount for this project with own forces. List type of work/specialties and percentage of total contracted amount for this project to be performed with own forces. Attach separate sheet as needed.

Work/Specialty

- 1.4** Bidder must list work/specialties and percentage of total contracted amount for this project that will be performed by Subcontractors. List company name(s), address(s), phone no.(s) and representative information. Attach separate sheet as needed.

Work/Specialty	Percentage (%)	Company Name/Address/Phone/Contact

PART 2 – BIDDER'S INFORMATION

2.1 Bidder's Information

In order to make a responsive Bid, Bidder must answer all questions completely and all information must be clear, accurate and comprehensive. If necessary, questions may be answered on separate attached sheets. **The forms to complete this requirement are attached hereto as Attachment A.**

PART 3 – EXPERIENCE REQUIREMENTS

The Bidder must provide the following information with its Bid:

3.1 In order to make a responsive Bid, the Bidder must provide evidence of a minimum of three (3) successfully completed projects of comparable size, complexity and scope within the United States successfully completed by the Bidder within the past five (5) years, meeting the criteria listed on this form in subsection 3.1.1, if applicable.

3.2 This documentation shall be presented sufficiently and completely to demonstrate such services have been successfully provided by the Bidder for at least five (5) continuous year(s). **The forms to complete this requirement are attached hereto as Attachment B.**

If the Bidder chooses to fulfill any of the specific experience requirements listed in this document with subcontracted resources, the Bidder must indicate so on Attachment B, to be submitted with its bid. Additionally, Attachments E and I must be submitted with its bid. In accordance with paragraph 1.1, above.

3.2.1 Not Used.

3.3 In order to make a responsive Bid, the Bidder shall provide information on the experience of its proposed Project Manager and Superintendent by completing Attachment C, located at the end of this Section. The submitted Attachment C should include information and resumes for both the Bidder's Project Manager and Superintendent, indicating a minimum of three (3) successfully completed projects of similar size, complexity, and scope within the past ten (10) years. **The forms to complete this requirement are attached hereto as Attachment C.**

The Bidder shall provide the following information at the time of bid.

3.4 Attachment D - Not Used.

The OWNER seeks CONTRACTORS that can complete the Work within the Contract time given for completion. Anything that might negatively impact a Bidder's ability to timely complete the Work may result in the Bidder being determined to not be the most responsible Bidder.

3.5 Attachment E - Not Used.

3.6 Attachment F - Not Used.

3.7 Attachment G - Not Used.

3.8 Attachment H - Not Used.

3.9 Authentication

The Bidder must authenticate and acknowledge the preceding information by providing witness in the presence of a notary public duly licensed and authorized to act in that capacity under the laws and

statutes of the State of Texas, on the form provided on the following page. **The forms to complete this requirement are attached hereto as Attachment I.**

Attachment A
BIDDER'S INFORMATION
(To be returned with the Bid)

Bidder must answer all questions completely and all information must be clear, accurate and comprehensive. If necessary, questions may be answered on separate attached sheets.

- A. Name of Bidder: _____
- B. Bidder's Permanent Address: _____
- C. Bidder's Phone No.: _____
- D. Number of years in business under current company name: _____

(Note: A minimum of five (5) year's existence as a business is required under the current company name. Changes in company name during the experience period are acceptable if the continuity of the company structure can be demonstrated. Attach separate documentation, if applicable.)

If response is "YES" for questions E – H, attach brief description or explanation

- E. Has the Bidder ever defaulted on a contract?
YES (___) NO (___)
- F. Are there currently any judgments, claims, or lawsuits pending against the Bidder?
YES (___) NO (___)
- G. Does Bidder currently have any claims, judgments or lawsuits pending against any prior client?
YES (___) NO (___)
- H. Is the Bidder or principals of Bidder now, or has the Bidder or principals of Bidder ever been, involved in any bankruptcy or reorganization proceedings?
YES (___) NO (___)

Attachment B
STATEMENT OF EXPERIENCE
(To be returned with the Bid)

Using the summary format included below, list and describe Bidder's construction experience for a minimum of three (3) successfully completed projects of comparable size, scope and complexity to the Work described in the Contract Documents. The Bidder must have completed the projects within the past five (5) years. Part 3 of this section outlines the experience requirements which must be demonstrated with the three (3) successfully completed sample projects. (Use additional sheets as deemed necessary or appropriate.)

Are any of the experience requirements outlined in Part 3 to be fulfilled by subcontracted resources?

(circle one) YES / NO

NOTE: If yes, Attachment E (Statement of Experience for Bidder's Listed Subcontractors) and Attachment J (Authentication of Post-Bid Submittal) as well as any other required Post-Bid forms must be submitted as a Post-Bid Submittal as outlined in Paragraph 1.2 of Section #00400.

Project No. 1 - Experience

Name of Project: _____ Location: _____

OWNER's Name and Address: _____

OWNER's Contact Person (Print): _____ Phone/Fax No.: _____ / _____

Payment Bond (circle one) YES / NO

Performance Bond (circle one) YES / NO

Initial Contract Price: _____ Final Contract Price: _____

Total Contract Amount Performed by Own Forces: _____

Contract Start Date: _____ (Date of Notice To Proceed)

Contract Time: _____ () Calendar Days () Working Days

Contract Substantial Completion Date: _____

Actual Substantial Completion Date: _____

If contract completion time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each.

Project Description and Statement of Relevance to this Contract:

Project No. 2 - Experience

Name of Project: _____ Location: _____

OWNER's Name and Address: _____

OWNER's Contact Person (Print): _____ Phone/Fax No.: _____ / _____

Payment Bond (circle one) YES / NO

Performance Bond (circle one) YES / NO

Initial Contract Price: _____ Final Contract Price: _____

Total Contract Amount Performed by Own Forces: _____

Contract Start Date: _____ (Date of Notice To Proceed)

Contract Time: _____ () Calendar Days () Working Days

Contract Substantial Completion Date: _____

Actual Substantial Completion Date: _____

If contract completion time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each.

Project Description and Statement of Relevance to this Contract:

Project No. 3 – Experience

Name of Project: _____ Location: _____

OWNER's Name and Address: _____

OWNER's Contact Person (Print): _____ Phone/Fax No.: _____ / _____

Payment Bond (circle one) YES / NO

Performance Bond (circle one) YES / NO

Initial Contract Price: _____ Final Contract Price: _____

Total Contract Amount Performed by Own Forces: _____

Contract Start Date: _____ (Date of Notice To Proceed)

Contract Time: _____ () Calendar Days () Working Days

Contract Substantial Completion Date: _____

Actual Substantial Completion Date: _____

If contract completion time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each.

Project Description and Statement of Relevance to this Contract:

Attachment C

STATEMENT OF EXPERIENCE FOR BIDDER'S LISTED PROJECT MANAGER & SUPERINTENDENT

(To be returned with the Bid)

Attach resumes for the following personnel who will be assigned to this project. The resumes must demonstrate that these individuals have worked on at least three (3) similar, successfully completed projects in the capacity of Project Manager or Superintendent, or other supervisory capacity, as applicable, during the last 10 years.

Project Manager (name): _____

Superintendent (name): _____

Insert Resumes & Experience

Attachment I
AUTHENTICATION OF BID SUBMITTAL

(To be returned with the Bid)

The Bidder must authenticate and acknowledge the preceding information by providing witness in the presence of a notary public duly licensed and authorized to act in that capacity under the laws and statutes of the State of Texas, on the form provided on the following page.

NOTARIZE ONLY THE LAST PAGE OF THIS FORM

Signed By: _____

Typed Name: _____

Typed Title: _____

Limited Partnership Acknowledgement

State of Texas

County of _____

Before me _____ (insert Notary's name), a Notary Public, on this day personally appeared _____ (insert name of person signing on behalf of general partner of limited partnership), _____, title of officer or manager and _____, name of corporation or LLC); the General Partner of _____ (insert name of limited partnership), known to me personally or on the basis of legally sufficient identification to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.

[Seal] Given under my hand and seal of office this ____ day of _____, A.D., 20____.

Notary Public, State of Texas

Signed By: _____

Typed Name: _____

Typed Title: _____

Corporation or Limited Liability Company Acknowledgement

State of Texas

County of _____

Before me _____ (insert Notary's name), a Notary Public, on this day personally appeared _____ (insert name of person signing on behalf of corporation or LLC) as _____ (title of officer or manager and name of corporation or LLC); known to me personally or on the basis of legally sufficient identification to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.

[Seal] Given under my hand and seal of office this __day of _____, A.D., 20_____.

Notary Public, State of Texas

SECTION 00410

BID BOND

BIDDER (Name and Address):

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

OWNER (Name and Address):

City of Deer Park
710 E. San Augustine Street, Harris County
Deer Park, Texas 77536

BID

BID DUE DATE:

PROJECT:

BOND

BOND NUMBER:

DATE (Not later than Bid due date):

PENAL SUM:

(Words)

(Figures)

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

BIDDER

SURETY

_____(Seal)
Bidder's Name and Corporate Seal

_____(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title

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

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, OWNER or other party shall be considered plural where applicable.

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.

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 by 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 total time for issuing Notice of Award including extensions shall not in the aggregate exceed 90 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. Notices 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 or 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 this Bond conflicts with 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.

TECHNICAL REQUIREMENTS

DEER PARK SPORTS FIELDS

PROJECT A:

SOCCER FIELD DEVELOPMENT (PHASE 1)

PROJECT B:

GIRLS SOFTBALL RENOVATIONS

SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification:

1. Project A: Soccer Field Development - Phase 1
Project Location: East Blvd. and East 13th St., Deer Park, Texas.
2. Project B: Girls Softball Renovations
Project Location: 407 West X St., Deer Park, Texas.

B. Owner: City of Deer Park, Texas.

C. Landscape Architect: Halff Associates. Civil Engineer: Halff Associates. MEP Engineer: Halff Associates. Concession Building Architect: MODE Architects. Concession Building MEP Engineer: Hendrix Consulting Engineers Concession Building Structural Engineer: 360 Engineering, Inc.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. Includes PROJECT A: the new construction and development of Soccer Fields in Deer Park, Texas.
2. Includes PROJECT B: the new construction and development of the Girls Softball Renovations in Deer Park, Texas.

B. Type of Contract.

1. Projects will be constructed under a single prime contract.

1.4 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.5 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work on site to legal working hours (hours to be coordinated with the City of Deer Park), Monday through Saturday, except as otherwise indicated by city ordinance.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner or adjacent landowners' occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Smoking is not permitted, except in the parking lot.
- F. Controlled Substances: Use of other controlled substances on the Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

1.8 COMPLETENESS REQUIREMENT

- A. The intent of the contract documents is to require all items necessary for the proper execution and completion of the work by the Contractor. The contract documents are complimentary and by their intent a complete and usable work product is expected to be provided. To meet this requirement the Contractor is expected to provide construction in place to include that which is indicated in the contract documents and that which may be reasonable expected to be required to make the work complete in all respects and consistent with established and accepted construction practices.
- B. It is not the intent of this article to require scope-of-work which is not required for completeness or which is not reasonably inferable through an examination of the contract documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Project A: Soccer Field Development - Phase 1

1. Alternate No. A1: Add installation solid sod in lieu of sod sprigging at Soccer Fields 1, 2, 3, and 4.
 - a. Base Bid: Install sod sprigs for field turfgrass.
 - b. Alternate: Install solid sod for field turfgrass.
 - c. Refer to Drawings for configuration of Soccer Fields.
2. Alternate No. A2: Add installation of Turn-Key construction of Soccer Fields 5 and 6.
 - a. Base Bid: Construction of Soccer Fields 5 and 6 to include clearing/grubbing, grading, and hydromulch seed to create practice field areas.
 - b. Alternate: Turn-key construction of Soccer Fields 5 and 6 is included as an Add Alternative Bid. Items to include clearing, grubbing, grading, irrigation system, sprigging to create game fields.
 - c. Refer to Drawings for configuration of Soccer Fields.
3. Alternate No. A3: Deduct installation of Shade Structures at bleacher areas between Fields 1 and 3 and Fields 2 and 4.
 - a. Base Bid: Turn-key construction of Shade Structures at bleacher areas between Fields 1 and 3 and Fields 2 and 4.
 - b. Alternate: Deduct Shade Structures from base bid.
 - c. Refer to Drawings for location of Shade Structures.
4. Alternate No. A4: Deduct installation of Bleachers between Fields 1 and 3 and Fields 2 and 4.
 - a. Base Bid: Install Bleachers between Fields 1 and 3 and Fields 2 and 4.
 - b. Alternate: Deduct installation of Bleachers between Fields 1 and 3 and Fields 2 and 4.
 - c. Refer to Drawings for Bleacher locations.
5. Alternate No. A5: Deduct installation of team benches.
 - a. Base Bid: Install team benches.
 - b. Alternate: Deduct installation of team benches.
 - c. Refer to Drawings for team bench locations.
6. Alternate No. A6: Add installation of 136 additional wheel stops along the interior parking spaces.
 - a. Base Bid: Does not include the 136 additional wheel stops along the interior parking spaces.
 - b. Alternate: Add installation of 136 additional wheel stops along the interior parking spaces.
 - c. Refer to Drawings for configuration of parking area.

B. Project B: Girls Softball Renovations

1. Alternate No. B1: Deduct installation of turn-key 24' x 30' Maintenance Building.
 - a. Base Bid: Install turn-key 24' x 30' Maintenance Building.
 - b. Alternate: Deduct installation of turn-key 24' x 30' Maintenance Building.

- c. Refer to Drawings for location, notes and description of Maintenance Building.
- 2. Alternate No. B2: Add installation of turn-key 30' x 50' Maintenance Building in lieu of 24' x 30' Maintenance Building.
 - a. Base Bid: Install turn-key 24' x 30' Maintenance Building.
 - b. Alternate: Add installation of turn-key 30' x 50' Maintenance Building in lieu of 24' x 30' Maintenance Building. Contact Stephen Simmons with Mueller, Inc., for product description. Ph. 281-345-0760.
 - c. Refer to Drawings for location, notes and description of Maintenance Building.
- 3. Alternate No. B3: Add installation of water line to extend to the Maintenance Building
 - a. Base Bid:
 - b. Alternate: Extend water to maintenance building. Connect ¾" water line to proposed 2" water line stub. Provide shut-off valve in cast box flush with finish grad. Route water line from underground to new maintenance building. Piping shall be Type L copper.
 - c. Refer to Drawings for configuration of Maintenance Building Area.
- 4. Alternate No. B4: Deduct the installation of concrete mow strips along the perimeter of the softball field fencing.
 - a. Base Bid: Install concrete mow strips along the perimeter of the softball field fencing.
 - b. Alternate: Deduct the installation of concrete mow strips along the perimeter of the softball field fencing.
 - c. Refer to Drawings.
- 5. Alternate No. B5: Deduct installation of Shade Structures at bleacher areas.
 - a. Base Bid: Turn-key construction of Shade Structures at bleacher areas.
 - b. Alternate: Deduct Shade Structures from base bid.
 - c. Refer to Drawings for location of Shade Structures.
- 6. Alternate No. B6: Add installation of decomposed granite base with synthetic turf for batting cage surface, in lieu of skinned infield (clay) material.
 - a. Base Bid: Batting cage surface to be infield (clay) material.
 - b. Alternate: Add installation of decomposed granite base with synthetic turf for batting cage surface, in lieu of skinned infield (clay) material.
 - c. Refer to Drawings for batting cage area and layout.
- 7. Alternate No. B7: Deduct the installation of 64 wheel stops along outside perimeter of the new parking area.
 - a. Base Bid: Install 183 wheel stops as noted in drawings.
 - b. Alternate: Deduct the installation of 64 wheel stops along outside perimeter of the new parking area.
 - c. Refer to Drawings.
- 8. Alternate No. B8: Deduct installation of Type 2 free standing bleachers at Fields 4 and 5.
 - a. Base Bid: Install Type 2 free standing bleachers at Fields 4 and 5.
 - b. Alternate: Deduct installation of Type 2 free standing bleachers at Fields 4 and 5.
 - c. Refer to Drawings.
- 9. Alternate No. B9: Add installation of
 - a. Base Bid:
 - b. Alternate:
 - c. Refer to Drawings for
- 10. Alternate No. B10: Add installation of

- a. Base Bid:
- b. Alternate:
- c. Refer to Drawings for

END OF SECTION 012300

SECTION 014536

PROTECTION OF THE ENVIRONMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and applicable Provisions of the Contract, including General and Supplementary Conditions, and applicable Division Specification Sections apply to this section.

1.2 SCOPE OF WORK

- A. The Contractor in executing the work, shall maintain all work areas on and off the site free from environmental pollution that would be in violation of any federal, state, or local regulations.

1.3 PROTECTION OF STORM DRAINAGE AND SEWER SYSTEM

- A. Take adequate measures to prevent the impairment of the operation of the existing storm drainage and sewer systems. Prevent construction materials, concrete, earth, or other debris from entering any storm drainage and sewer system. All storm or sewage flow interfering with construction and requiring diversion shall be diverted by the Contractor to a point acceptable to the Owner.

1.4 PROTECTION OF WATERWAYS

- A. The Contractor shall observe the rules and regulations of the State of Texas and agencies of the U.S. Government prohibiting the pollution of any lake, stream, river, or wetland by the dumping of any refuse, rubbish, dredge material, or debris therein.
- B. Contractors are specifically cautioned that disposal of materials into any waters of the State must conform with City of Deer Park, State of Texas, and applicable Federal requirements.
- C. The Contractor shall be responsible for providing an approved method which will handle, carry through, or divert around his work all flows, including storm flows and flows created by construction activity, so as to prevent erosion resulting in silting of waterways or flooding damage to the property. Suggested methods for erosion control are shown in the drawings. Contractor shall prepare and submit a Storm Water Pollution Prevention Plan (SWP3) for Owner's approval prior to beginning work. Refer to Section 01 57 13 for Erosion Control Guidelines and Example SWP3.
- D. The Contractor shall comply with the procedures outlined in the U.S. Environmental Protection Agency manuals entitled "Guidelines for Erosion and Sedimentation Control Planning and Implementation" and "Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity."

1.5 DISPOSAL OF WASTE MATERIAL

- A. The Contractor shall make his own arrangements for disposal of waste materials subject to submission of proof to the Owner that owner(s) of the proposed site(s) has a valid fill permit issued by the appropriate governmental agency and submission of a haul route plan including a map of the proposed route(s).
- B. Unacceptable disposal sites include, but are not limited to, sites which have a detrimental effect on surface water or groundwater quality.
- C. The Owner, at his discretion, may suspend operation of the Contractor for alleged non-compliance with Texas Water Commission, Texas Department of Health or Environmental Protection Agency Regulations.

1.6 PROTECTION OF AIR QUALITY

- A. Air pollution shall be minimized by wetting down bare soils during windy periods, or as requested by Owner; by requiring the use of properly operating combustion emission control devices on construction vehicles and equipment used by Contractor; and by encouraging the shutdown of motorized equipment not actually in use.
- B. Trash burning will not be permitted on the construction site.
- C. If temporary heating devices are necessary for protection of the work, such devices shall be of a type that will not cause pollution of the air.

1.7 USE OF CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, reactant or of other classification, must show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture, or any other applicable regulatory agency. Use of all such chemicals and disposal of residues shall be in conformance with the manufacturer's instructions. Petroleum products shall be identified and stored in safety approved containers.

1.8 NOISE AND DUST CONTROL

- A. The Contractor shall so conduct all his operations that they will cause the least annoyance to the residents in the vicinity of the work, and shall comply with all applicable local ordinances. The compressors, hoists, and other apparatus shall be equipped with such mechanical devices as may be necessary to minimize noise and dust. Compressors shall be equipped with silencers on intake lines. All gasoline or oil operated equipment shall be equipped with silencers or mufflers on intake and exhaust lines. Storage bins and hoppers shall be lined with material that will deaden the sounds if directed by the Owner.
- B. The operation of dumping materials and of carrying materials away in trucks shall be so conducted as to cause a minimum of noise and dust. Vehicles carrying sands, dirt, rock, concrete, or other material shall be routed over such streets as will cause the least annoyance to the public and shall not be operated on public streets between the hours of 9:00 p.m and 6:00 a.m., or on Sundays or legal holidays unless approved by the Owner and the City of Wylie.
- C. All unpaved streets, roads, detours, or haul roads used in the construction area shall be given an approved dust-prevention treatment or periodically watered to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.
- D. Dust prevention treatment shall be performed to the satisfaction of the Owner.

1.9 MAINTENANCE AREA

- A. Concrete pad with area for oil changes and maintenance is required.
- B. Fuel storage areas will be protected from external flooding and internal spillage by berm.
- C. If required for additional erosion control, wash area for trucks shall be maintained in conjunction with stabilized construction entrance.

END OF SECTION 014536

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation manuals for systems, subsystems, and equipment.
 - 2. Product maintenance manuals.
 - 3. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Format: Submit operations and maintenance manuals in the following format:
 - 1. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- B. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.

5. Name and contact information for Contractor.
 6. Name and contact information for Architect.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.

9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Required by contractor when contractor accepts digital files at no charge. Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
- B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

B. Format: Submit record Product Data as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

CIVIL SPECIFICATIONS

DEER PARK SPORTS FIELDS

**PROJECT A:
SOCCER FIELD DEVELOPMENT (PHASE 1)**

**PROJECT B:
GIRLS SOFTBALL RENOVATIONS**

**REFER TO THE CITY OF DEER
PARK'S**

**STANDARD DETAILS AND
SPECIFICATIONS**

SECTION 311100

SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SECTION INCLUDES

- A. Protection of existing features.
- B. Clearing and grubbing.
- C. Debris removal.

1.3 RELATED SECTIONS

- A. Field Grading – Section 312200
- B. Earth Moving – Section 312000
- C. GEOTECHNICAL ENGINEERING STUDY, Proposed Soccer Field Development, Phase 1, City of Deer Park, Texas – prepared by QC Laboratories – January 2017
- D. GEOTECHNICAL ENGINEERING STUDY, Deer Park Girl's Softball Renovations, City of Deer Park, Texas – prepared by QC Laboratories – January 2017

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Site clearing and grubbing shall consist of the removal and disposal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter from the construction area.

3.2 PREPARATION FOR WORK

- A. Verify that existing plant life designated to remain, if any, is tagged or identified, and protected as described in the Specifications.
- B. Verify and protect survey control.

3.3 PROTECTION OF EXISTING FEATURES

- A. Locate, identify, and protect from damage utilities to remain.
- B. Protect trees, plant growth, and features designated to remain.
- C. Protect bench marks and survey control from damage or displacement.

3.4 CLEARING AND GRUBBING

- A. The designated construction area shall be cleared of all trees, brush, shrubbery, and plants, not indicated on Drawings to be preserved. Trees and brush designated to be left in place shall be carefully trimmed as directed and shall be protected from scarring, barking or other injuries during construction operations. Pruned limbs over 2 inches in diameter shall be treated by painting the exposed ends with an approved asphaltic material. Stumps, roots, and other objectionable material shall be removed from areas requiring fill or from borrow sites and/or materials sources to the complete extent necessary to prevent objectionable matter from becoming mixed with the material to be used on construction.
- B. Unless otherwise provided, all merchantable timber removed as previously specified shall become the property of the Contractor. It is the intent of this specification to provide for the removal and disposal of all obstructions and objectionable materials not specifically provided for elsewhere by the Contract Documents.
- C. Remove existing concrete and asphalt paving, curb, gutter, walks and other items shown or described to be removed in the Contract Documents.
- D. Remove trees, shrubs and other plant life within the site shown or described to be removed in the Contract Documents. Remove tree and shrub stumps and root system to a depth of 24 inches below existing grades. Remove grass and ground cover root system to a depth of 4 inches.

3.5 DEBRIS REMOVAL

- A. Removed material shall become the property of the Contractor. Contractor shall remove debris, rock, and extracted plant life from site and legally dispose.

3.6 TOP SOIL

- A. Strip topsoil from limits of grading areas, clean of grass, roots, rocks and debris to a depth of between 4" to 6", and stockpile for placement on all landscape and "open space" areas. Contractor shall investigate the site to his satisfaction to determine if suitable material is available on site to meet the specification for topsoil. Refer to Field Grading Section 312200.

3.7 EROSION CONTROL

- A. Provide erosion control measures necessary to maintain site. Protect against both wind and rainfall erosion.
- B. Reference Division 1 - Section 01 57 13 and Division 31 - Section 31 35 10 for more specific requirements for erosion control.

END OF SECTION 311100

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating for buildings and structures.
2. Preparing subgrades for buildings and structures.
3. Backfilling for buildings and structures.
4. Excavating for walks and vehicular pavements, and for flexible porous pavement.
5. Preparing subgrades for walks and vehicular pavements, and for flexible porous pavement.
6. Subbase course for concrete walks & vehicular pavements, and for flexible porous pavement.
7. Preparing subgrades for turf and grasses.
8. Satisfactory fill course for turf and grasses.
9. Soil replacement at utility lines adjacent to or passing beneath structures (clay plug requirement).

B. Related Sections:

1. Section 32 18 00 - Athletic and Recreational Surfacing
2. Section 32 92 00.01 –Field Turf and Grasses
3. GEOTECHNICAL ENGINEERING STUDY, Proposed Soccer Field Development, Phase 1, City of Deer Park, Texas – prepared by QC Laboratories – January 2017
4. GEOTECHNICAL ENGINEERING STUDY, Deer Park Girl's Softball Renovations, City of Deer Park, Texas – prepared by QC Laboratories – January 2017

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
- B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- D. Fill: Soil materials used to raise existing grades.
- E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- F. Subbase: Aggregate layer placed between the subgrade and a cement concrete vehicular pavement or a cement concrete walkway, or an aggregate layer placed between the subgrade and asphaltic base course for hot-mix asphalt pavement.
- G. Base Course: Aggregate layer placed between the subgrade and flexible porous pavement. The BASE COURSE material is specified in Section 321243 Flexible Porous Pavement.
- H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, or topsoil materials.
- I. Select Fill: Imported structural fill material consisting of clayey sand or sandy clay with a liquid limit less than 35 and a plasticity index between 5 and 16 according to ASTM D4318.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- K. Pre-excavation Conference: Conduct conference at project site.

1.3 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- B. Do not commence earth moving operations until plant-protection measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations, or from on-site stockpiles provided by the City of Deer Park.
- B. Satisfactory Soils: Soil Classification Groups GC, SC, GW, GP, GM, SW, SP, and SM according to ASTM D 2487; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
 - 1. Liquid Limit: less than 40.
 - 2. Plasticity Index: 10 to 20.
- C. Unsatisfactory Soils: Soil Classification Groups CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within specified range of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Meet the requirements of TxDOT Item 247, Type A, Grades 1 or 2.

- E. Exposed Soil Playing Surface (Infield Clay): Red Ball Clay as supplied by Select Sand and Gravel, Fort Worth, Texas, 817/572-6310. Free of foreign debris, rock, gravel, organic or objectionable matter.

2.2 ACCESSORY MATERIALS

- A. Geotextile Filter Fabric: Composite Fabric, woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees.

3.2 EXCAVATION, GENERAL

- A. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. Remove topsoil, stockpile and identify this material so that it may be reinstalled as specified for topsoils.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Stiffened Slab-on-Grade Foundations will include the following:
 - a. Remove all existing pavements, surface vegetation, trees and associated root mats, organic topsoil and any other deleterious material.
 - b. Excavate surface clays to a minimum of 5.5 feet below finished grade. Scarify the exposed clay subgrade, at the base of the excavation, to a depth of 8 inches, adjust the moisture, and compact at a minimum of three percentage points above

optimum moisture to between 93 and 98 percent of Standard Proctor density (ASTM D 698). Over-compaction is not allowed.

- c. Extend excavation out 5 feet beyond footprint of foundation.
2. Excavations for Monument Signs will include the following:
 - a. Remove all existing pavements, surface vegetation, trees and associated root mats, organic topsoil and any other deleterious material.
 - b. Excavate surface clays to a minimum of 1 foot below bottom of proposed concrete sign base.

3.4 EXCAVATION FOR WALKS AND VEHICULAR PAVEMENTS

- A. Excavate surfaces under walks and vehicular pavements, including asphaltic concrete paving, and under areas of flexible porous pavement to indicated lines, cross sections, elevations, and subgrades, and as follows:
 1. Remove all existing pavements, surface vegetation, trees and associated root mats, organic topsoil and any other deleterious material.
 2. At concrete walks and pavements, excavate surface clays or fill with on-site or imported material to a minimum of 1-foot below 6-inch paving design grades, 11-inches below 5-inch paving design grades, or to the depth below the design grade which removes topsoil and exposes the clay subgrade, whichever is the greater depth of excavation. Scarify the exposed clay subgrade, at the base of the excavation, to a depth of 6 inches, adjust the moisture to -2 to +4 percentage points above optimum moisture and compact to a minimum 95 percent of Standard Proctor density (ASTM D 698). This will prepare the excavation for subbase installation.
 3. At areas of flexible porous pavement, excavate surface clays or fill with on-site or imported material to a minimum of 13-inches below paving design grades, or to the depth below the design grade which removes topsoil and exposes the clay subgrade, whichever is the greater depth of excavation. Scarify the exposed clay subgrade, at the base of the excavation, to a depth of 6 inches, adjust the moisture to -2 to +4 percentage points above optimum moisture and compact to a minimum 95 percent of Standard Proctor density (ASTM D 698). This will prepare the excavation for base course installation.
 4. At decomposed granite walkways, excavate surface clays or fill with on-site or imported material to a minimum of 8-inches below paving design grades, or to the depth below the design grade which removes topsoil and exposes the clay subgrade, whichever is the greater depth of excavation. Scarify the exposed clay subgrade, at the base of the excavation, to a depth of 6 inches, adjust the moisture to -2 to +4 percentage points above optimum moisture and compact to a minimum 95 percent of Standard Proctor density (ASTM D 698). This will prepare the excavation for subbase installation.
 5. Extend excavation out 1-foot beyond edge of paving.

3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade below structures and pavements with pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.
- C. Maintain subgrade in a moist condition until pavement is placed.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction using satisfactory fills.

3.7 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under building slabs, use select fill
 - 2. Under footings and foundations, use select fill.
 - 3. Under walks and pavements, use soil fills beneath the specified depth of subbase material.
 - 4. Under steps and ramps, use soil fills beneath the specified depth of subbase material.
 - 5. Under grass and planted areas and under soil playing surfaces, use on-site or imported soil material.

3.8 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within optimum moisture limits indicated for each condition.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content range and is too wet to compact to specified dry unit weight.

3.9 INSTALLATION AND COMPACTION OF SOIL BACKFILLS AND FILLS FOR STRUCTURES

- A. Place backfill and fill soil materials in layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight and optimum moisture range:
 - 1. Fill pad to 1 foot below final grade using satisfactory soils. Compact in maximum 9-inch loose lifts at a minimum of three percentage points above optimum moisture to between 93 and 98 percent of Standard Proctor density (ASTM D 698). Over-compaction is not allowed.

2. Complete pad fill using a minimum of 1 foot of sandy clay/clayey sand, non-expansive select fill with a Liquid Limit less than 35 and a Plasticity Index (PI) between 5 and 16. The select fill should be compacted in maximum 9-inch loose lifts at -2 to +3 percentage points of the soil's optimum moisture content at a minimum of 95 percent of Standard Proctor density (ASTM D 698). The select fill should be placed within 48 hours of completing the installation of the moisture conditioned soils. The moisture condition within the completed pad shall be maintained during construction.

3.10 INSTALLATION AND COMPACTION OF SOIL FILLS FOR USE BENEATH PAVEMENTS AND WALKS

- A. Where pavement subgrade must be raised place fill soil materials in layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place fill soil materials evenly to required elevations, and uniformly along the full length and width of paved areas.
- C. Compact soil materials of type described following and to not less than the following percentages of maximum dry unit weight and optimum moisture range:
 1. Fill using borrow fill found on-site, unsatisfactory imported soils if of same soil class as on-site borrow fill, imported satisfactory soil fill, or other soil if approved by the Owner. Compact in maximum 9-inch loose lifts at a minimum of three percentage points above optimum moisture to between 93 and 98 percent of Standard Proctor density (ASTM D 698). Over-compaction is not allowed. Extend fills to the underside elevation of the specified subbase.

3.11 INSTALLATION AND COMPACTION OF SUBBASE UNDER VEHICULAR PAVEMENTS AND WALKS

- A. PAVEMENT SUBBASE CONDITION 1 – Concrete Vehicular Pavements: Following scarification and recompaction of existing or filled subgrade, install subbase to underside elevation of designated pavement section. Install subbase in 9-inch maximum loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). A minimum 6-inch subbase is required.
- B. PAVEMENT SUBBASE CONDITION 2 – Walkway Pavements which are placed adjacent to or in proximity to structures (within 30-feet of structures): Following scarification and recompaction of existing or filled subgrade, install subbase course to underside elevation of designated pavement section. Install subbase course in 9-inch maximum loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). A minimum 6-inch subbase course is required.
- C. PAVEMENT SUBBASE CONDITION 3 – Walkway Pavements which are placed elsewhere on the site in areas which are not adjacent to or in proximity to structures: Following scarification and recompaction of existing subgrade, install subbase or satisfactory soils course to underside elevation of designated pavement section. Install subbase or satisfactory soils course in 9-inch maximum loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). A minimum 6-inch subbase or satisfactory soils course is required.

- D. PAVEMENT SUBBASE CONDITION 4 – NOT USED
 - E. PAVEMENT BASE COURSE CONDITION 5 – Flexible Porous Pavements: Following scarification and recompaction of existing subgrade, install base course to within 1-inch of pavement design grade. Install base course in 9-inch maximum loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). A minimum 12-inch base course is required. The BASE COURSE material is specified in Section 321243 Flexible Porous Pavement.
 - F. PAVEMENT SUBBASE CONDITION 6 – Decomposed Granite Walkway Surfaces: Following scarification and recompaction of existing subgrade, install subbase to within 6-inches of pavement design grade. Install subbase in 9-inch maximum loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). A minimum 6-inch subbase is required.
 - G. On prepared subgrades, place subbase and satisfactory soils courses under pavements and walks in a manner which follows the shape of required crowns and cross-slopes.
- 3.12 SUBGRADE PREPARATION AND FILL UNDER TURF AND GRASSES, UNDER EXPOSED SOIL PLAYING SURFACES (Infield Clay), AND AT FILTER STRIPS & BIOSWALES
- A. Excavate surfaces under turf and grasses, exposed soil playing surfaces and filter strips to indicated lines, cross sections, elevations, and subgrades, and as follows:
 - 1. Remove all existing pavements, surface vegetation, trees and associated root mats, organic topsoil and any other deleterious material. Stockpile topsoil for reinstallation.
 - 2. Excavate surface clays to a minimum of 1 foot below existing grade or 18-inches below design grades, whichever is the greater depth of excavation. Scarify the exposed clay subgrade, at the base of the excavation, to a depth of 6 inches, adjust the moisture to -2 to +4 percentage points above optimum moisture and compact to a minimum 95 percent of Standard Proctor density (ASTM D 698). This will prepare the excavation for soils installation.
 - 3. Where Filter Strip and Bioswale details indicate greater depth of excavation, excavate material to subgrade elevation indicated and scarify the exposed clay subgrade, at the base of the excavation, to a depth of 6 inches, adjust the moisture to -2 to +4 percentage points above optimum moisture and compact to a minimum 95 percent of Standard Proctor density (ASTM D 698).
 - 4. Extend excavation out 1-foot beyond edge of indicated areas.
 - B. Under Turf and Grasses: Following scarification and recompaction of existing subgrade, install soils course to within 4-inches of design grade. Install soils course in 9-inch loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). Soils may be borrow fill found on-site, unsatisfactory imported soils if of same soil class as on-site borrow fill, imported satisfactory soil fill, or other approved soil if approved by the Owner. Install topsoil at upper 4-inches to match design grade.
 - C. Under Exposed Soil Playing Surfaces (Infield Clay): Following scarification and recompaction of existing subgrade, install soils course to within 4-inches of design grade. Install soils course in 9-inch loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698). Soils may be borrow fill found on-site, unsatisfactory imported soils if of same soil class as on-site borrow fill, imported satisfactory soil fill, or other approved soil if approved by the Owner. Install geotextile

filter fabric prior to installation of Exposed Soil Playing Surface. Install Exposed Soil Playing Surface (Infield Clay) at upper 4-inches to match design grade.

- D. At Filter Strips and Bioswales: Following scarification and recompaction of existing subgrade, install soils as detailed. Soils may be borrow fill found on-site, unsatisfactory imported soils if of same soil class as on-site borrow fill, imported satisfactory soil fill, or other approved soil if approved by the Owner. Unless indicated to remain loose, install soils courses in 9-inch loose lifts at -2 to +3 percentage points of the material's optimum moisture content and compact to a minimum of 95 percent of Standard Proctor density (ASTM D-698).

3.13 SOIL REPLACEMENT AT UTILITY LINES ADJACENT TO OR PASSING BENEATH BUILDING (CLAY PLUG REQUIREMENT)

- A. Backfill for utility lines should consist of site-excavated satisfactory soil. Backfill should be compacted as recommended for select fill and soil backfills. Do not use granular material for embedment in utility trenches within 8 feet of building. Install a clay plug within the trench at these locations. The intent of this clay plug is to stop any free moisture from passing through the granular embedment and entering the soil beneath the structure.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Structures Subgrades: At each of the structures subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities.
- D. Paving Subgrades: At paving subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Agency will provide testing at each lift at area intervals no greater than 5,000 sf.

- E. Turf and Grasses and Exposes Soil Playing Surface Subgrades: At these subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Agency will provide testing at each lift at area intervals no greater than 20,000 sf.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property. This includes on-site stockpiles provided by the City of Deer Park.

END OF SECTION 312000

SECTION 31 2200

FIELD GRADING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

- A. Section Includes:

1. Excavating, filling, backfilling, grading, and compacting of earth at the site.
2. Preparation of building pad to limits shown on plans.
3. Provide and stockpile topsoil on site.
4. Dewatering excavations.

- B. Related Sections:

1. Section 32 18 00 - Athletic and Recreational Surfacing
2. Section 32 92 00.01 –Field Turf and Grasses

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):

1. ASTM D 698 78 Tests Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures, Using 5.5 lb. Hammer and 12 in. Drop.
2. ANSI/ASTM D2922 Density of Soil in Place by the Nuclear Methods.

1.04 SUBMITTALS

- A. Submit in accordance with SECTION 01 3300 – SUBMITTALS.

- B. Samples: Submit a one gallon sample and material analysis results of imported topsoil from a testing laboratory indicating compliance with these specifications. Any topsoil delivered to the site which does not comply with the approved sample shall be retested at the Contractor's expense and replaced.

- C. Test Reports:

1. Submit copies of test reports in accordance with SECTION 014000 – QUALITY REQUIREMENTS.
2. Compaction Tests: Submit copies of compaction test reports.

1.05 QUALITY ASSURANCE

- A. Laboratory Control: On site or Imported topsoil shall be inspected and tested by an independent testing laboratory.
 - 1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

1.06 PROJECT CONDITIONS

- A. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.
- B. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.
- C. Protection:
 - 1. Property: Protect adjoining property, including improvements outside the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.
 - 2. Protect benchmarks.
 - 3. Protect above and below grade utilities which are to remain.
 - 4. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Monitor shoring system and surrounding ground surface during construction to detect movement. If movement becomes significant, take contingency steps to brace excavation and adjacent utility lines.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Topsoil:
 - 1. Strip topsoil from limits of grading areas, clean of grass, roots, rocks and debris to a depth of between 4" to 6", and stockpile for placement on all landscape and "open space" areas. Contractor shall investigate the site to his satisfaction to determine if suitable material is available on site to meet the specification for topsoil.
 - 2. Imported topsoil shall be required for all fields a minimum depth of 4".
 - a. Contractor shall haul and place imported topsoil obtained from offsite sources to construct the topsoil layer and various other details of the construction drawings. All costs related to such imported topsoil fill will be included in the contract price, and no additional or separate payment for imported fill will be due the Contractor.
 - b. Topsoil shall be secured from an approved offsite location. It shall be fertile, friable, natural loam containing a liberal amount of humus and

shall be capable of sustaining vigorous plant growth. It shall be free of stone lumps, clods of hard earth, plants or their roots, sticks, and other extraneous matter. Under no circumstances will topsoil be accepted unless it is free of the aforementioned contaminants. Contractor may use approved means of treating the topsoil to ensure its acceptability. Imported topsoil shall be rock free.

- c. The soil texture shall be classified as sandy loam or loamy sand according to the "soil triangle" published by the United States Agriculture Department and the following criteria:
 - 1.) Natural organic content: Not less than 1.5%.
 - 2.) pH of Soil: Not more than 7.6.
 - 3.) Soil texture shall be determined by utilizing processes as prescribed in ASTM D 422 using the No. 10 and No. 270 sieves and a hydrometer analysis.
- 3. Unsuitable Materials: Topsoil or unclassified fill will be declared as "unsuitable" if any of the following conditions or matter and particles are present to a degree that is judged detrimental to the proposed use of the material:
 - a. Moisture.
 - b. Decayed or undecayed vegetation.
 - c. Hardpan clay, heavy clay, or clay balls.
 - d. Rubbish.
 - e. Construction rubble.
 - f. Sand or gravel.
 - g. Rocks, cobbles, or boulders.
 - h. Cementitious matter.
 - i. Foreign matter of any kind.
- 4. Unsuitable materials shall be disposed of properly and legally as "waste".

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Establish extent of excavation by area and elevation; designate and identify datum elevation.
- B. Set required lines and grades using a licensed surveyor.
- C. Maintain bench marks, monuments and other reference points.

3.02 PREPARATION

- A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

- B. Notify utility companies sufficiently in advance to remove and relocate lines which are in way of excavation.
- C. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.
- D. Protect and support utility services uncovered by excavation.
- E. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.
- F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.
- G. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Landscape Architect.
- H. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded, see section 31 0000 Earthwork.
- I. Scarify the subgrade soil of infield areas to a minimum depth of 6 inches, water and recompact. Compact to a minimum of 90 percent of maximum dry density as determined in accordance with ASTM D698 (Standard Proctor), within three percent points of the soil's optimum moisture content.
- J. Scarify general subgrade soils in place to a depth of 6 to 8 inches and compact to between 90 and 95 percent for lawn areas, both at or above optimum moisture content, in accordance with ASTM D698.

3.03 EXCAVATION

- A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the sod and infield materials. Excavate as required regardless of the condition or type of material encountered.
 - 1. Cut areas accurately to the indicated grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.
 - 2. Remove underground obstructions except for piping and conduit which shall be handled as specified.
- B. Over cut planting and lawn areas to allow a layer of topsoil not less than 4" thick.
- C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.
- D. Exercise extreme care in grading around existing features such as fences and drain inlets.
- E. Do not disturb existing grades around existing trees except as otherwise noted. When excavation through roots is necessary, and after review by Landscape Architect, perform by hand and cut roots with sharp axe, prune trees to compensate for root loss.
- F. Fill over-excavated areas under structure bearing surfaces in accordance with original Architect's direction.

- G. Do not allow construction equipment to create "pumping" of soils.
- H. Stockpile excavated clean fill for reuse where directed. Remove excess or unsuitable excavated fill from site.

3.04 WASTING

- A. Surplus excavated material not suitable or required for fill and backfill shall be wasted off site.

3.05 FILL AND BACKFILL

- A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.

1. Complete stripping and wasting operations in advance of fill construction. Proof roll, compact, and establish moisture content.
2. Deposit and mix fill material in horizontal layers not more than 6" deep, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
3. Fill material shall have a moisture content at or slightly above optimum, to achieve specified compaction. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.
4. Exercise care to prevent movement or breakage of walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.
5. Proof roll exposed subgrade in building and paving areas with heavily loaded dump truck or similar acceptable construction equipment, to detect unsuitable soil conditions. Commence proof rolling operations after a suitable period of dry weather to avoid degrading acceptable subgrade surfaces. Make four passes over each section with proof rolling equipment, with the last two perpendicular to the first two.
6. Cut out soft areas of subgrade not readily capable of in-situ compaction. Backfill and compact to density equal to requirements for subsequent backfill material.

- B. Backfilling: Construct compacted fill below finish grade.

1. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.
2. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
3. Bring backfill to required grades by depositing material in horizontal layers not more than 6" deep, loose measurement.
4. Site backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
5. Maintain optimum moisture content of backfill materials to attain required compaction density.

6. Make gradual changes in grade. Blend slopes into level areas.

3.06 COMPACTION

- A. Compact each layer of earth fill and backfill thoroughly and evenly until there is no evidence of further compaction and a solid and uniform density is secured.
 1. Compact each layer of fill to the density listed below as a function of the location. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
 2. Material under lawn areas shall be compacted to sod providers recommendations.
 3. A large vibratory rolling machine as illustrated shall be used for compaction during grading process:



3.07 FINISH GRADING

- A. Site Grading: Shape and finish earthwork to bring the site to the finish grades and elevations shown on the drawings.
 1. Finish grade to the finish contours and spot grades shown. Extend cuts and fills to feather out beyond the last finish contour or spot grade shown. Grade to uniform levels and slopes between points for which elevations are given, round off abrupt changes in elevation, and finish off smoothly. Finish grades shall slope to assure proper drainage.
 2. The final grading of the field will be accomplished with a small light weight type tractor equipped with turf tires and laser equipment. (Motor graders not allowed for final grading).
 3. Laser to be either conical or dual slope laser depending on the grading plan with the capability of achieving an accuracy of 1/8 of an inch in 100 feet.

4. The finished grade should be true to plane and grade within 1/4 of an inch when checked with a 20 foot straight edge.
 5. Finish grade shall be properly compacted, dragged and ready for sod then be inspected by the landscape architect before the grassing operation. It is the intent of these specs to have a smooth surface without any bumps or undulations, that drains as designed.
 6. All area's where grass meets other materials will be graded to allow for the thickness of the sod. Grading, infield materials, warning tracks, and sod installation will be the responsibility of the same contractor to insure a smooth transition from one material to the next.
 7. Execute erosion control measures in accordance with the local ordinances.
- B. Grading Around Trees: Where grading is required within the branch spread of trees that are to remain, perform the work as follows:
1. When trenching occurs, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by hand digging.
 2. When the existing grade at a tree is below the new finished grade, and fill not exceeding 6" is required, clean washed gravel graded from 1" to 2" size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18" and finish approximately 2" above the finished grade at the tree. Install gravel before earth fill is placed.
 3. Trees in areas where the new finished grade is to be lowered shall have regrading work done by hand to elevation as indicated. Existing grades immediately surrounding the trunk shall not be altered except at the direction of the Architect.

3.08 PLACING TOPSOIL

- A. Prior to placing topsoil, scarify subgrade to a depth of 5". Following scarification, topsoil shall be spread in one 4" thick lift or as defined on the plans. Topsoil shall be compacted to the approximate density of undisturbed soil. If there is insufficient stockpiled topsoil from onsite sources to complete the work, bring in topsoil from offsite sources as needed. After topsoil has been placed blade, roll lightly and rake as required to comply with 3.08, B below.
- B. After placement of topsoil, eliminate all low or hollow places that would allow water to stand or pond during rainfall or during operation of lawn irrigation systems. The area shall be free of all natural debris and shall also be free of all clods and rocks.
- C. Finish surfaces shall not vary more than 1/4 inch from established grade elevation.
- D. Provide uniform roundings at top and bottom of slopes and other breaks in grade. Correct irregularities and areas where water will stand.
- E. Uniformly distribute topsoil to required grades; feather back to where grades remain unchanged.

3.09 PROTECTION, CLEAN UP AND EXCESS MATERIALS

- A. Protect grades from construction and weather damage, washing, erosion and rutting, and repair such damage that occurs.

- B. Correct any settlement below established grades to prevent ponding of water.
- C. At locations where concrete or other foreign matter has penetrated or been mixed with earth, remove damaged earth and replace with clean material.
- D. Remove excess stockpiled material, debris, waste, and other material from site and leave work in clean finished condition for final acceptance. Contractor is responsible for disposal of debris and excess materials.

3.10 CONSTRUCTION STAKING

- A. All field layouts must be staked using the coordinates provided in the plans in addition to the grading and dimensional control plans. The contractor's surveyor shall stake all base locations and points of grade break in order to achieve a smooth and uniform grade throughout. Verify all grades and elevations are per plans.

END OF SECTION 312200

LANDSCAPE ARCHITECTURE SPECIFICATIONS

DEER PARK SPORTS FIELDS

PROJECT A:
SOCCER FIELD DEVELOPMENT (PHASE 1)

PROJECT B:
GIRLS SOFTBALL RENOVATIONS



321243 ... FLEXIBLE POROUS PAVEMENT (TRUEGRID).....	15
321313 ... PORTLAND CEMENT CONCRETE PAVING.....	2
321314 ... PAVEMENT MARKINGS.....	2
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323300 ... SITE FURNISHINGS.....	2
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SECTION 02795 [32 12 43]

POROUS FLEXIBLE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Base course, over sub-base prepared by others.
- B. Porous Pavers.
- C. Parking Delineators.
- D. Gravel fill.
- E. Grass fill.

1.2 RELATED SECTIONS

- A. Section 02300 - Earthwork: Grading, subbase preparation and compaction.
- B. Section 02620 - Subdrainage System.
- C. Section 02700 - Pavements, Sidewalks, Curbing and Appurtenances.
- D. Section 02800 - Site Improvements and Amenities.
- E. Section 02810 - Irrigation System.
- F. Section 02920 - Turf and Grasses.

1.3 REFERENCES

- A. AASHTO - Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges..

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- C. Shop Drawings: Submit manufacturer's shop drawings including laying pattern and parking delineators locations.
- D. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
 - 1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
 - 2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
- E. Samples: Submit two square samples of Permeable Pavers Units product specified.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic fertilizing and maintenance.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum for five years documented experience with the products specified.
- B. Installer Qualifications: Installer experienced in performing work of this section that has specialized in installation of work similar to that required for this project. Installer must also be able to provide skilled workman with satisfactory record of performance on landscaping or paving projects of comparable size and quality.

C. Pre-Installation Meetings:

1. Convene a pre-installation meeting a minimum of two weeks prior to start of porous paving systems.
2. Verify project requirements, subbase and base conditions, manufacturer's installation instructions and coordination with other related work.
3. Require attendance of parties directly affecting work of this section, including the Contractor, Architect, engineer, and installer. Manufacturer's representative may attend by phone conference as needed.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect porous paver units from damage during delivery and store under tarp when time from delivery to installation exceeds 30 days.
- C. Protect materials during handling and installation to prevent damage.

1.7 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions recommended by manufacturer for desired results. Do not install products under conditions outside manufacturer's absolute limits.
- B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas, including concrete walks and asphalt paving, is completed.
- C. Install turf when ambient air temperature is at least 55 degrees F.
- D. In wet weather, do not build on wet, saturated or muddy subgrade
- E. In cold weather, do not use frozen materials or materials coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.
- F. Protect partially completed porous paving against damage from other construction traffic when work is in progress.
- G. Protect Grass Fill / Sodded paving areas from traffic until grass root system has matured for at least 3 to 4 weeks. Use barricades to only permit accessible by emergency and fire equipment

1.9 WARRANTY

- A. Provide with the manufacture's 5 year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: TRUEGRID Pavers; 2500 Summer St., Suite 3225, Houston, TX 77007. Phone: 1-855-355-GRID. Email: nwood@truegridpaver.com Website: www.truegridpaver.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 PRODUCTS

- A. Permeable Pavers, TRUEGRID ECO for grass or gravel applications.
 - 1. AASHTO H20, HS20 Rated.
 - 2. Manufactured in the USA.
 - 3. High density polyethylene (HDPE): 100 percent post-consumer recycled materials
 - 4. Recycled and recyclable content: 100 percent post-consumer recycled materials
 - 5. Color: black- carbon black additive for long term UV stabilization
 - 6. Paver size: 24 inches by 24 inches by 1 inch.
 - 7. Pre-assembled 4 foot by 4 foot sections
 - 8. Cylindrical cell design for column strength
 - 9. Cell size: 3.25 inch inside diameter
 - 10. Co-joined cells at 48 places for strength
 - 11. Wall thickness: 0.240 inch at 48 load bearing points per paver; 0.120-inch nominal
 - 12. Connections:

- a. No clips or stakes necessary
 - b. No additional parts or tools needed
 - c. Integral male-female three point locking system
 - d. Wall thickness at tabs: 0.290 inch
- 13. Molded in X-anchors to stabilize pavers: no stakes necessary
 - 14. S-Flexural joints molded in for soil seasonal expansion and contraction
 - 15. Nominal Coverage per Paver: 4 square feet
 - 16. Weight per paver: 2.55 lbs
 - 17. Permeability of System: 100 percent
 - 18. Compressive Strength (filled): 892,800 psf; 6200 psi
 - 19. Material Safety: ground water neutral, 100 percent inert
 - 20. Chemical Resistant: Excellent: highly resistant to hydrocarbons, oils

B. Permeable Pavers, TRUEGRID PRO for grass or gravel applications.

- 1. AASHTO H20, HS20 Rated.
- 2. Manufactured in the USA.
- 3. High density polyethylene (HDPE): 100 percent post-consumer recycled materials
- 4. Recycled and recyclable content: 100 percent
- 5. Color: black- carbon black additive for long term UV stabilization
- 6. Paver size: 16 inches by 16 inches by 1.8 inches.
- 7. Pre-assembled: 4 foot by 4 foot sections
- 8. Cylindrical cell design for column strength
- 9. Cell size: 3.25 inch inside diameter
- 10. Co-joined cells at 16 places for strength
- 11. Wall thickness: 0.150-inch nominal
- 12. A minimum of 2 co-joined common walls per cell for structural integrity
- 13. Connections:

- a. No clips or stakes necessary
 - b. No additional parts or tools needed
 - c. Integral male-female three point locking system
 - d. Wall thickness at tabs: 0.290 inch
- 14. Molded in X-anchors to stabilize pavers: no stakes necessary
 - 15. S-Flexural joints molded in for soil seasonal expansion and contraction
 - 16. Nominal Coverage per Paver: 4 square feet
 - 17. Weight per paver: 2.22 lbs.
 - 18. Permeability of System: 100 percent
 - 19. Compressive Strength (filled): 1,152,000 psf; 8000 psi
 - 20. Material Safety: ground water neutral, 100 percent inert
 - 21. Chemical Resistant: Excellent: highly resistant to hydrocarbons, oils

C. Permeable Pavers, TRUEGRID PRO PLUS for grass or gravel applications.

- 1. AASHTO H20, HS20 Rated.
- 2. Manufactured in the USA.
- 3. High density polyethylene (HDPE): 100 percent post consumer recycled materials
- 4. Recycled and recyclable content: 100 percent
- 5. Color: black- carbon black additive for long term UV stabilization
- 6. Paver size: 24 inches by 24 inches by 1.8 inches.
- 7. Pre-assembled: 4 foot by 4 foot sections
- 8. Cylindrical cell design for column strength
- 9. Cell size: 3.30 inch inside diameter
- 10. Co-joined cells at 48 places for strength
- 11. Wall thickness: 0.150 inch /.250-inch nominal
- 12. A minimum of 2 co-joined common walls per cell for structural integrity
- 13. Connections:

- a. No clips or stakes necessary
 - b. No additional parts or tools needed
 - c. Integral male-female three point locking system
 - d. Wall thickness at tabs: 0.290 inch
 - 14. Molded in X-anchors to stabilize pavers: no stakes necessary
 - 15. S-Flexural joints molded in for soil seasonal expansion and contraction
 - 16. Nominal Coverage per Paver: 4 square feet
 - 17. Weight per paver: 5.25 lbs.
 - 18. Permeability of System: 100 percent
 - 19. Compressive Strength (filled): 1,152,000 psf; 8000 psi
 - 20. Material Safety: ground water neutral, 100 percent inert
 - 21. Chemical Resistant: Excellent: highly resistant to hydrocarbons, oils
- D. Parking Delineators: TRUEGRID SuperSpot for grass or gravel applications.
- 1. H20, HS20 rated
 - 2. Domed and ribbed for super strength.
 - 3. Long term UV stabilized
 - 4. 0.90-inch profile above grid
 - 5. 3.25-inch diameter
- E. Base Course: TRUEGRID was developed to accept multiple acceptable base materials. Locally sourced angular stone/clean for base material. Crushed granite, sandy gravel material, crushed concrete, limestone rock, and crushed lava are some of the acceptable materials. Variations in permeability of aggregate should be:
- 1. Conforming to the following sieve analysis and requirements:
 - a. Percent Passing: 100 - Sieve Size: 3/4 – 1 inch
 - b. Percent Passing: 85 - Sieve Size: 3/8 inch
 - c. Percent Passing: 60 - Sieve Size: #4
 - d. Percent Passing: 30 - Sieve Size: #40

- e. Percent Passing: <3 - Sieve Size: #200
 - 2. Sources of the material may include “pit run” or “crusher run”. Crusher run material will typically require sand to be added (20 to 30 percent by volume) for long term high porosity. Should local sources not be available an alternative mixture can be created by mixing 2/3 crushed stone (0.75 inch diameter) with 1/3 sand as available.
 - 3. Geo grid or Geo fabric may be required for soil stabilization between sub grade and base material. Consult with site engineer or TRUEGRID for specifics or recommendation.
- F. Gravel Fill: Obtain clean, washed angular rock to fill the 1.0-inch-tall TRUEGRID ECO cells and spaces between. TRUEGRID can be filled to top of cells and exposed or overfilled to hide cells. Fill rock should be 1/2 inch to 3/4 inch diameter.
- 1. TRUEGRID’s design does not require anchors on level ground or slopes up to 10 degrees. TRUEGRID is designed for slopes above 10 degrees. However, as a precaution, anchors/staking may be considered per each sloped install above 10 degrees.
 - 2. Fill rock to top of cells for ADA compliance
- G. Gravel Fill: Obtain clean, washed angular rock to fill the 1.8-inch-tall TRUEGRID PRO cells and spaces between. TRUEGRID can be filled to top of cells and exposed or overfilled to hide cells. Fill rock should be 5/8 inch to 3/4-inch diameter.
- 1. TRUEGRID’s design does not require anchors on level ground or slopes up to 10 degrees. TRUEGRID is designed for slopes above 10 degrees. However, as a precaution, anchors/staking may be considered per each sloped install above 10 degrees.
 - 2. Fill rock to top of cells for ADA compliance
- H. Gravel Fill: Obtain clean, washed angular rock to fill the 1.8-inch-tall TRUEGRID PRO PLUS cells and spaces between. TRUEGRID can be filled to top of cells and exposed or overfilled to hide cells. Fill rock should be 5/8 inch to 3/4-inch diameter.
- 1. TRUEGRID’s design does not require anchors on level ground or slopes up to 10 degrees. TRUEGRID is designed for slopes above 10 degrees.

However, as a precaution, anchors/staking may be considered per each sloped install above 10 degrees.

2. Fill rock to top of cells for ADA compliance
- I. Grass Fill: A sandy loam or loam soil should be used to fill the empty grass paver cells. The selection of sandy loam or loam soil should be made based upon the soil requirements of the turf variety selected for the project. Other soils if compatible with type of seed or sod are acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Before beginning installation, verify site conditions are as indicated on the drawings. Notify the Architect if site conditions are not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.
- B. Ensure that adjacent hard-surfaced paving work is completed before installing porous pavement system.

3.2 PREPARATION

- A. Subgrade:
 1. Prepare subgrade as specified in Section 02700. Verify subgrade in accordance with porous paving system manufacturer's instructions.
 2. Excavate area allowing for unit thickness and the engineered base depth (where required).
 3. Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
 4. Ensure in-place soil is relatively dry and free from standing water.

5. Uniformly grade base.
6. Level and clear base of large objects, such as rocks and pieces of wood.

B. Base Preparation:

1. Install Base as specified in Section 02700. Verify engineered base is installed in accordance with porous paving system manufacturer's instructions.
2. Coordinate base installation and preparation with subdrains specified in Section 02620.
3. If required, place a geotextile separation layer between the natural ground and the 'engineered base.
4. Place base course material over prepared sub base to grades indicated on the Drawings or from manufacturer's recommended depths per application type.
5. Place in lifts not to exceed 4 inches, compacting each lift separately to 95 percent Modified Proctor for non-open grade material. Open grade base material to be leveled and heavily compacted in 4 inch lifts to settle and lock in angular stone.
6. Leave minimum 1.8 inch for Permeable Paver unit for final elevation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

- B. Install TRUEGRID ECO Permeable Paver units by placing cells face up. Sheets are preassembled in 4 foot by 4 foot sheets are connected with friction fit interlocking connectors. No tooling are required to connect or disconnect units. Sheets may be separated into 4 Individual 24 inch by 24 inch pieces and reconfigured as needed. Cut units around curves and organic shapes with an electrical handsaw. Place units to maintain a 1 inch clearance to any pre-installed object or surface structure. Top of cells shall be between 0.25 inch to 0.5 inch below the surface of adjacent hard-surface pavements.

- C. Install TRUEGRID PRO Permeable Paver units by placing cells face up. Sheets are preassembled in 4 foot by 4 foot sheets are connected with friction fit interlocking connectors. No tooling are required to connect or disconnect units. Sheets may be separated into 9 Individual 16 inch by 16 inch pieces and reconfigured as needed. Cut units around curves and organic shapes with an electrical handsaw. Place units to maintain a 1 inch clearance to any pre-installed object or surface structure. Top of cells shall be between 0.25 inch to 0.5 inch below the surface of adjacent hard-surface pavements.
- D. Install TRUEGRID PRO PLUS Permeable Paver units by placing cells face up. Sheets are preassembled in 4 foot by 4 foot sheets are connected with friction fit interlocking connectors. No tooling are required to connect or disconnect units. Sheets may be separated into 4 Individual 24 inch by 24 inch pieces and reconfigured as needed. Cut units around curves and organic shapes with an electrical handsaw. Place units to maintain a 1 inch clearance to any pre-installed object or surface structure. Top of cells shall be between 0.25 inch to 0.5 inch below the surface of adjacent hard-surface pavements.
- E. Gravel Surfacing: Install Gravel into TRUEGRID cavities by back dumping directly from dump truck or from buckets mounted to tractors. Hand shoveling fill gravel into the cells is also acceptable for smaller jobs.
1. Direct vehicles to exit the site by driving forward. Avoid sharp turns over unfilled rings.
 2. Spread gravel fill using steer loaders, power brooms, blades, flat bottomed shovels, and/or wide "asphalt rakes" to fill the cells.
 3. Compact gravel when the cells are at capacity with a roller for larger areas or vibrating plate for smaller areas.
 4. If fully covering TRUEGRID cells, typical coverage is 0.25 inch to 0.5 inch above cells.
- F. Hydro seeding/Hydro-Mulch Surfacing: Provide and place as specified in Section 02920 - Lawns and Grasses. Homogeneously mix a combination of water, seed and fertilizer in a truck mounted tank. Spray the seed mixture onto the site at specification rates. Coverage should be uniform and complete. Following germination of the seed, areas lacking germination larger than 8 inches by 8 inches must be reseeded immediately. Seeded areas must be fertilized and kept moist during development of the turf.

- G. Sod: Provide and place as specified in Section 02920 - Lawns and Grasses. Use 0.5-inch-thick (soil thickness) rolled sod from a reputable grower. Species should be wear resistant, free from disease, and in excellent condition.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Gravel fill: Avoid sharp turns or “jack knives” in trailered vehicles when cells are empty. Damage due to buckling can occur. TRUEGRID can be driven on pre-fill by gravel trucks and construction equipment to speed the installation process.
- C. Grass Fill / Seeded: Protect seeded areas from any traffic, other than emergency vehicles, for a period of 4 to 6 weeks, or until the grass is mature to handle traffic. Avoid sharp turns or “jack knives” in trailered vehicles when cells are empty. Damage due to buckling can occur.
- D. Grass Fill / Sodded: Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until root system has been established.
- E. Dumpster areas: A concrete pad is recommended for dumpster areas due to the drop and drag action. Permeable pavers are not recommended in these areas under and directly around the dumpster.
- F. Repair or replace damaged products before Substantial Completion.

3.5 MAINTENANCE

- A. For gravel fill surfaces, maintain a 0.5 in (13 mm) surcharge of aggregate as a surface wear course. Surface should be inspected from time to time to identify signs of slight cell infill loss.

- B. Maintain grass in accordance with manufacturer's instructions and as specified in Section 02920 - Lawns and Grasses.
- C. Monitor pavement to ensure traffic frequency and loading does not exceed the pavement design.
- D. When snow removal is required, keep a metal edged plow blade from coming in contact with the surface during plowing operations to avoid causing damage to the units. Use a plow blade a minimum of 1 inch above the surface and with a flexible rubber edge or with skids on the lower outside corners so the plow blade does not come in contact with the units.

END OF SECTION

SECTION 321313

PORTLAND CEMENT CONCRETE PAVING (CIVIL)

DIVISION 2 – SITE WORK

PART 1 - GENERAL

1.0 GENERAL:

- A. The Conditions of the Contract and applicable requirements of Division 0 – General Requirements apply to the work of this section. Applicable sections of the North Central Texas Council of Government (NCTCOG) Standard Specifications for Public Works Construction as modified herein, also apply.
- B. The City of Wylie requirements shall also apply.

1.1 SECTION INCLUDES:

- A. The furnishing of all labor, material and equipment to complete placement of all Portland Concrete Pavement as shown in the plans.

1.2 RELATED SECTIONS:

- A. Applicable Sections of Division 1 – General Requirements.
- B. Applicable Sections of Division 31 – Earthwork.
- C. Applicable Sections of Division 32 – Exterior Improvements.
- D. Applicable Sections of the Referenced Specifications.
- E. Special Provisions.

1.3 REFERENCE SPECIFICATIONS:

- A. All work covered in this section shall be governed by the latest edition of the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.
- B. Work not described herein or in the NCTCOG Standard Specifications shall be governed by the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges.

PART 2 - PRODUCTS

2.0 GENERAL:

- A. This part shall include the furnishing of all material of the dimensions and types as shown on the Drawings or as established by the Engineer.

2.1 MATERIALS:

- A. Materials shall be in accordance with the applicable portions of the NCTCOG Standard Specifications.

PART 3 - EXECUTION

3.0 GENERAL:

- A. This part shall include the placing of all specified materials at the locations and elevations as shown on the Drawings or as established by the Engineer.
- B. The work performed hereunder shall conform in every respect to the Contract Documents, applicable City requirements, applicable local ordinances, and regulations of the Occupational Safety and Health Administration (OSHA). In the event that the Contract Documents do not adequately specify materials, methods of construction, or workmanship of any portion of the proposed work, the NCTCOG Standard Specifications for Public Works Construction, as amended in the Contract Documents, shall apply.

3.1 INSTALLATION:

- A. Construction methods shall be in accordance with the NCTCOG Standard Specifications, as amended by these specifications.

END OF SECTION 321313

SECTION 321314
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pavement markings

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Pavement Markings Layout: For each parking area.

1.3 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to concrete pavement marking.

1.4 PROJECT CONDITIONS

- A. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials], and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color: White, or as indicated.
- B. Fire Lane Striping Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color: White text on red background, configuration as required by City Ordinance

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete paving to cure for a minimum of 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 markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.2 PAVEMENT MARKINGS SCHEDULE

- A. Schedule is found on site plans.

END OF SECTION 321312

SECTION 321800

ATHLETIC AND RECREATIONAL SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes placement and compacting of clay surfacing for softball fields and supplementary items required for installation.
- B. All skinned areas, pitcher's rubber and home plate cut outs shall be constructed of Diamond Pro materials or approved equal. Alternate submittals shall include a one pound sample of material with detailed specifications of the product and manufacturer as well as five product references of installed applications.

1.02 DELIVERY

- A. Deliver infield dirt and infield conditioner in truck beds that have been completely cleaned of gravel or other foreign materials. Reject materials that contain foreign materials.

PART 2 - PRODUCTS

2.01 PRODUCT STANDARD

- A. The Contract Documents are based on the following product to establish a standard of quality.
 - 1. Manufacturer: Diamond Pro®, a subsidiary of TXI. (1-800-228-2987)
 - 2. Products:
 - a. Infield Surfacing:
 - 1) Diamond Pro® Infield Dirt: A proprietary blended and screened infield mix of approximately 65% sand and 35% clay / silt.
 - 2) Diamond Pro® Red Infield Conditioner: A proprietary infield conditioner made from special raw clay then heated in a rotary kiln to produce a vitreous material.
 - b. Home Plate / Infield Clay and Clay Bricks:
 - 1) Diamond Pro® Home Plate / Infield Clay: A screened clay loam with a rich red color.
 - 2) Diamond Pro® Clay Bricks: Unfired, compressed clay bricks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate surfaces to receive infield surfacing and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Landscape Architect.

3.02 INSTALLATION - INFIELD SURFACING

- A. General: Provide a 5-inch total thickness of infield surfacing consisting of 4-inches of compacted Infield Dirt and 1-inch total Infield Conditioner, finely graded to the elevations and contours indicated on the Drawings.
- B. Sub-grade: Excavate to a minimum depth of 5-inches to receive the infield surfacing.
- C. Placement: Spread Diamond Pro® Infield Dirt evenly over the entire excavated infield surface in one layer to a depth of 4-inches and compact. Spread Diamond Pro® Red Infield Conditioner over the Infield Dirt to a depth of $\frac{3}{4}$ -inch, then roto-till to a depth of approximately 3-inches. Level and roll-pack entire infield surfacing. Add a $\frac{1}{4}$ -inch layer of Red Infield Conditioner as a top dressing and screen-drag for a level-playing surface.
- D. Compaction: Compact the Infield Surfacing to between ninety percent and ninety-five percent of maximum density (standard proctor) by rolling with a small one-ton roller.
- E. Fine grading: Fine-grading of the infield surfacing shall be true to line, grade and cross section. When tested with a 12-foot straight edge, it shall have no deviation from the face of the straight edge in excess of $\frac{1}{4}$ -inch at any point. Correct all points of the surface not meeting these requirements.

END OF SECTION

SECTION 323113

CHAIN LINK FENCES AND GATES and SPORTS FIELD BACKSTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes chain-link fences and swing gates, and sports field backstops.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, and backstops, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework and post spacing indicated.
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following, but in no case provide materials of lesser dimension than those indicated on drawings or specified:
 - a. Wind Loads: as indicated in the referenced building code for this project and locale.
 - b. Exposure Category: B.
 - c. Fence Height: as indicated in drawings or as specified.
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe or IC, electric-resistance-welded round steel pipe.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each product and for each color and texture specified, in 6-inch lengths for linear components, 12-inch square pieces for woven products and full-sized units for accessories.
- D. Delegated-Design Submittal: For chain-link fences and gate framework indicated, and for sports field backstops to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Texas-registered professional engineer responsible for their preparation.
- E. Product Certificates: For each type of chain-link fence and gate, and for sports field backstops from manufacturer.
- F. Product Test Reports: For framing strength according to ASTM F 1043.
- G. Operation and maintenance data.

- H. Sample of special warranty.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates and sports field backstops that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: As indicated on Drawings.
 - 2. Steel Wire Fabric: Wire with a diameter of 0.192 to .203 inch (6-gauge).
 - a. Mesh Size: 2 inches
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
 - 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts and fitted caps. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
 - 1. Fence Height: As indicated on Drawings.
 - 2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 2.375 inches in diameter.
 - b. End, Corner and Pull Post: 4.0 inches.
 - 3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043.
 - 4. Brace Rails: Comply with ASTM F 1043.
 - 5. Metallic Coating for Steel Framing:
 - a. Type A zinc coating.
 - b. Coatings: Any coating above.

2.3 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
 - 1. Gate Leaf Width: As indicated.
 - 2. Gate Fabric Height: As indicated
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded or assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 180-degree outward swing.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 - 3. Padlock and Chain: Owner furnished.

2.4 FITTINGS

- A. General: Comply with ASTM F 626.

2.5 HIGH DENSITY POLYETHYLENE SHADING FABRIC

- A. Material: UV Stabilized Shadesure fabric by Multi Knit Ltd. Manufacture to meet tensile structural applications. Manufacture with monofilament and tape filler of 195g per square meter weight and burst strength of 260 kpa. Meet ASTM E 84-91a Class A fire resistance. Provide tamper resistant cable and fittings system for attachment. Locate where indicated on drawings.
- B. Color: As selected by Architect from manufacturer's full range.

2.6 SPORTS FIELD BACKSTOP

- A. Product: Traditional style 20-foot height baseball backstop system. Locate where indicated on drawings. System shall be designed to give full protection and clear visibility through the backstop for the spectators as well as the players. The baseball backstop shall be of corrosion resistant hot dipped galvanized finish. Pipes, fittings and hardware to be included in same finish. The .192 to .203 inch 6-gauge chain link fabric shall be galvanized. Provide one manufacturer's complete system
- B. Components: Upright posts shall be 4-1/2" O.D. schedule 40 pipe of height required to produce overall backstop height indicated on drawings. Provide concrete footing for embedment of uprights. Uprights shall be set minimum 4'-0" into 54-inch minimum depth concrete footing. Concrete footing shall be minimum 24-inch diameter. Delegated design must confirm size of footings and embedment, but in no case may footings be of lesser size than described here. Space uprights no greater than 10'-0" apart center to center. Uprights shall be finished off with 4-1/2" pipe caps. The baseball backstop shall be reinforced with truss-rods to triangulate structural support. Horizontal rails shall support each upright to upright. The horizontal rails shall be 1-5/8" O.D. by .083. wall thickness and spaced at 5'-0" apart from the top.

- C. Backstop Fabric: Baseball backstop consists of chain link fence fabric that is commercial grade knuckle to knuckle 2" by .192 to .203 inch 6-gauge of 10'-0" height sections. Fabric shall be tensioned at each end upright and in each corner upright with tension bars and bands. The intermediate attachment shall be to horizontal rails and upright pipes with steel ties of 8-1/4" length. and 18" length.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.
- G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- H. Line Posts: Space line posts uniformly at 96 inches o.c., unless indicated otherwise on drawings.

- I. Horizontal Rails: Provide top and bottom rails at fence assemblies. Provide top, bottom and intermediate rails at fence assemblies of 8 feet and greater height. Where bottom rails are placed above concrete walkways, anchor rails at mid-point between posts.
- J. Chain-Link Fabric: Apply fabric to field side of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated.
- K. Polyethylene Shading Fabric: Install in locations indicated, securely anchored in place.
- L. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- M. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 323113

SECTION 129300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Related Sections include the following:
 - 1. Division 03 Section 312000: "Earthwork"
 - 2. Division 33 Section 033000: "Cast-in-Place Concrete"

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.
- B. Product Schedule: For site furnishings. Use same designations indicated on Drawings.
- C. Maintenance Data: For site and street furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain **each type of** site furnishing through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Free Standing Bleacher Type 1:
 - a. GT Grandstands, Model: PT-0533GDC with guard rail, size: 27' x 5 rows.
 - 2. Free Standing Bleacher Type 2:
 - a. GT Grandstands, Model: PT-0533GDC with guard rail, size: 21' x 5 rows.

3. Shade Structures:
 - a. USA Shade and Fabric Structures, Model: DBLCH-8028-11-6
4. Soccer Team Benches:
 - a. Kwick Goal, Model: 9B22, Aluminum, clear anodized. Bench planks 10'.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site and street furnishings, where required.
- B. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.
- C. Install site and street furnishings level, plumb, true, and **securely anchored** and **positioned** at locations indicated on Drawings.

3.3 CLEANING

- A. After completing site and street furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32300

SECTION 328400
PLANTING IRRIGATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, point of connection and all other services required for the installation of a complete underground permanent, as shown on drawings and/or specified herein. When the term "Contractor" is used in this section, it shall refer to the irrigation Contractor.
- B. Related Work Specified Elsewhere:
 - 1. Seeding and Sodding: Section 02930.
 - 2. Landscaping: Section 02950.
 - 3. Organic Landscape Maintenance – One (1) Year: Section 02980.

1.2 QUALITY ASSURANCE

The following Codes, Regulations, Reference Standards, and Specifications apply to work included in this section: ASTM: D2241, D2464, D2466, D2564, and D855.

1.3 WARRANTY AND MAINTENANCE

- A. The Contractor shall warranty material and workmanship for one year after final acceptance including repair and replacement of defective materials, workmanship, and labor.
- B. Maintenance during warranty shall include, but not necessarily be limited to, the following:
 - 1. Adjustment of sprinkler height and plumb to compensate for settlement and/or plant growth.
 - 2. Backfilling of all trenches.
 - 3. Adjustment of head coverage (arc of spray) as necessary.
 - 4. Unstopping heads plugged by foreign material.
 - 5. Drip System:
 - a. Remove disc stack and rinse with water and replace every 6 months.
 - b. Compare the controller runtimes and frequency to the to the application rate for Techline CV at the spacing used. If the amount of water in inches/hour is insufficient or exceeds the requirement of the plant, adjust accordingly.
 - c. Refer to "Techline Design Manual" by Netafimusa.com.
 - 6. Adjustment of controller as necessary to insure proper sequence and watering time.
 - 7. All maintenance necessary to keep the system in good operating order. Repair of damage caused by vandals, other contractors or weather conditions shall be considered extra to these specifications.
- C. Warranty and maintenance after final acceptance does not include alterations as necessitated by re-landscaping, re-grading, addition of trees or the addition, and/or changes in sidewalks, walls, driveways, etc.
- D. Installations must declare compliance with section 1903.251, Texas Occupations Code.

1.4 SUBMITTALS

- A. The Contractor shall submit shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit,

fittings, drip irrigation lines and components, and all other types of fixtures and equipment proposed to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity, and manufacturer's installation recommendation, if applicable, for each proposed item.

- B. No partial submittal will be accepted and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Owner's Representative.
- C. Shop drawings shall include dimensions, elevations, construction, details, arrangements, and capacity of equipment, as well as manufacturer's installation recommendations.

1.5 "APPROVED EQUAL" SUBSTITUTIONS

Several items in this section and on the plans are specified by a manufacturer's brand name and catalog number, followed by the phrase "or approved equal". This is not intended to unduly restrict competitive procurements or bidding, but is done to assure a minimum standard of quality which is believed to be best for the item specified.

1.6 CODES/PERMITS

- A. All work under this section shall comply with the provisions of these Specifications, as illustrated on the accompanying drawings, or as directed by the Owner's Representative and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this Project.
- B. Installation of equipment and materials shall be done in accordance with requirements of the National Electrical Code, City of Deer Park Plumbing Code, and standard plumbing procedures. The drawings and these Specifications are intended to comply with all the necessary rules and regulations; however, some discrepancies may occur, the Contractor shall immediately notify the Owner's Representative in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these Contract Documents.
- C. The Contractor shall give all necessary notices, obtain all permits, and pay all costs in connection with his work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Owner's Representative.
- D. The Contractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on the drawings and/or specified.
- E. The installation of the irrigation system shall be made by an individual or firm duly qualified with a minimum of five years experience installing systems of similar size and scope, and licensed under Article No. 8751 VTCS, Titled "Licensed Irrigators Act", S.B. No. 259 as passed by the 66th Texas Legislature.

1.7 EXISTING UTILITIES

- A. Locations and elevations of various utilities included with the scope of this work have been obtained from the most reliable sources available and should serve as a general guide without guarantee to accuracy. The Contractor shall examine the Site and verify to his own satisfaction the locations and elevation of all utilities and availability of utilities and services required. The Contractor shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at his own expense, and to the satisfaction of the Landscape Architect, for damage to any utility shown or not shown on the plans.

- B. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Landscape Architect for instructions as to further action.
- C. Contractor shall make necessary adjustments in the layout as may be required to connect to existing stub-outs, should such stub-outs not be located exactly as shown and as may be required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Landscape Architect prior to final acceptance.

1.8 RETRO-FIT

- A. Various locations marked "RETRO-FIT" on the plan includes:
 - 1. Sprinkler pressure line re-routing (do not exceed pipe flows greater than 5fps).
 - 2. Existing gate valves, Controllers, control valves, drip irrigation shall be repaired, replaced and or re-routed in the field to best fit properties impacted.
 - 3. Follow all installation details shown on irrigation detail sheet.
 - 4. All adjustments made to other property owner's irrigation systems shall be approved in writing by all parties impacted (BEFORE COMENCING ANY WORK).

1.9 RECORD DRAWINGS

- A. Record dimensioned locations and depths for each of the following:
 - 1. Point of connection to proposed backflow device as shown on plan.
 - 2. Sprinkler pressure line routing (provide dimensions for each 100 lineal feet (maximum) along each routing, and for each change in directions).
 - 3. Gate valves.
 - 4. Sprinkler control valves (buried only).
 - 5. Control wire routing.
 - 6. Drip irrigation assemblies.
 - 7. Other related items as may be directed by the Owner's Representative.
- B. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs, or pavements).
- C. Record all changes which are made from the Contract drawings, including changes in the pressure and non-pressure lines.
- D. Record all required information on a set of blackline prints of the Contract drawings. Do not use these prints for any other purpose.
- E. Maintain information daily. Keep Contract drawings at the Worksite at all times and available for review by the Owner's Representative.
- F. When record drawings have been approved by the Owner's Representative, transfer all information to a set of reproducible mylars using permanent ink or provide a bond copy and electronic file on CD of the final record as-built drawings. Changes using ball-point pen are not acceptable. Make dimensions accurately at the same scale used on original Drawings, or larger. If photo reduction is required to facilitate controller chart housing, notes or dimension must be a minimum 1/4 inch in size.
- G. Reproducible mylars and/or bonds and CD will be furnished by the Owner cost for printing and handling.

1.10 CONTROLLER CHART

- A. Do not prepare chart until record drawings have been approved by the Owner's Representative.

- B. Provide one controller chart for the stations used on the automatic controller(s).
 - 1. Chart may be a reproduction of the record drawing, if the scale permits fitting within the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2. Chart shall be blackline print of the actual system, showing the area covered by that controller.
- C. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage.
- D. Following approval of chart by the Owner's Representative, it shall be hermetically sealed between two layers of 20 mil. thick plastic sheet.
- E. Chart must be completed and approved prior to final acceptance of the irrigation system.

1.11 OPERATING AND MAINTENANCE MANUALS

- A. Provide individual bound manuals detailing operating and maintenance requirements for irrigation systems.
- B. Manuals shall be delivered to the Owner's representative for review and approval no later than 10 days prior to completion of work. Revise manual as required.
- C. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate, and maintain the equipment.
- D. Provide the following in each manual:
 - 1. Index sheet, stating Irrigation Contractor's name, address, telephone number, and name of person to contact.
 - 2. Duration of guarantee period.
 - 3. Equipment list providing the following for each item:
 - a. Manufacturer's name.
 - b. Make and model number.
 - c. Name and address of local manufacturer's representative.
 - d. Spare parts list in detail.
 - e. Detailed operating and maintenance instructions of major equipment.
 - 4. Recommended programs for watering by season.

1.12 CHECKLIST

- A. Provide a signed and dated checklist, and deliver to the Owner's Representative prior to final acceptance of the work.
- B. Use the following format:
 - 1. Plumbing permits: if none required, so note.
 - 2. Material approvals: approved by and date.
 - 3. Pressure line tests: by whom and date.
 - 4. Record Drawings: received by and date.
 - 5. Controller charts: received by and date.
 - 6. Materials furnished: received by and date.
 - 7. Operation and maintenance manuals: received by and date.
 - 8. System and equipment operation instructions: received by and date.
 - 9. Manufacturer's warranties if required: received by and date.
 - 10. Written guarantee: received by and date.
 - 11. Lowering of heads in lawn areas: if incomplete, so state.

1.13 ELECTRIC POWER

Electric power to operate the controller shall be furnished by the Electrical Contractor unless otherwise noted on the plans. Service wiring to the controller cabinet shall be furnished by the Irrigation Contractor.

1.14 WATER FOR TESTING

Unless noted otherwise on the plans or elsewhere, water is available on the site necessary for testing, flushing, and jetting.

1.15 BORINGS, SLEEVES AND ELECTRICAL CONDUITS

Sleeves and electrical conduits are the responsibility of the Irrigation Contractor to install prior to paving or related construction and should be installed as noted on the approved irrigation plan. Contractors shall be responsible for locating all sleeves and conduits at no additional cost to the Authority. Borings under existing paving will be required where noted on the drawings and shall be provided at no additional cost to the Owner. Borings shall be a minimum of 18 inch depth and new pipes shall be incased in Schedule 40 PCV sleeves.

1.16 ATTIC STOCK - SPARE PARTS

The Contractor shall supply the Owner with five parts each of irrigation system components excluding controller, mainline pipe and lateral pipe. These items will be kept for use by the Owner after the Organic Landscape Maintenance for One (1) Year (Section 02980) period is completed.

1.17 COMMISSIONING

- A. This Section specifies a system which will be commissioned as part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Commissioning Coordinator.
- B. Refer to Division 1 Section 01810, Commissioning, for detailed commissioning requirements.
- C. Commissioning requires the participation of this Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the Division 1 Section 01810 referenced above. This Contractor shall be familiar with all parts of the Commissioning Section and the commissioning plan issued by the Commissioning Coordinator and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.18 POINT OF CONNECTION

- A. Verify main, meter location, and water pressure at the site, if minimum residual water pressure is less than required, notify owner's representative prior to construction. Contractor shall notify the owner's representative of such and shall receive owners' approval prior to any construction.
- B. Follow all state and local codes.

PART 2 - PRODUCTS

2.1 GENERAL

Unless otherwise noted on the plans, all materials shall be new and unused. The irrigation equipment catalog numbers used for reference in these Specifications are to establish minimum quality standards and may be substituted with an "approved equal" as outlined in Paragraph 1.06 of this section, unless specifically requested by the campus maintenance staff and noted as having no "approved equal" to be accepted.

2.2 POLYVINYL CHLORIDE PIPE (PVC PIPE)

PVC pipe manufactured in accordance with ASTM Standards noted herein.

- A. Marking and Identification: PVC pipe shall be continuously and permanently marked with following information: Manufacturer's name, size, type of pipe, and material, PVC number, Product Standard number, and the NSF (National Sanitation Foundation) Seal.
- B. PVC pipe fittings: Shall be of the same material as the PVC pipe specified and compatible with PVC pipe furnished. Solvent weld type shall be for Schedule 40.
- C. PVC Pipe: Lateral line pipe shall be Class 200 solvent weld, SDR-21, PS 22-70 for all sizes 3/4" - 2". All 1/2" pipe shall be solvent weld SDR- 13.5, Class 315. Mainline pipe shall schd.40 pvc.
- D. Flexible PVC Risers (Nipples): All flexible PVC nipples shall be made from virgin PVC material, and shall comply with ASTM D2287, shall be tested at 200 P.S.I. static pressure for 2 hours and have a quick burst rating of a minimum 400 P.S.I. Flexible PVC pipe nipples shall be factory assembled only.

2.3 SWING JOINTS

Swing joints shall be O-ring seal type. Use Lasco or approved equal.

2.4 WIRE AND SPLICES

- A. All wire shall be single strand solid copper, minimum 14 gauge with type UF insulation which is Underwriters Laboratory approved for direct underground burial when used in a National Electrical Code Class II Circuit (30 volts AC or less) as per Articles 725 and 300. Voltage drop shall be taken into consideration.
- B. All wire shall be color coded so that the common wire shall have white insulation and the signal wires shall have red insulation.
- C. All splices shall be made with King one step Dry splices Tan or Larger.
- D. All connectors shall be UL listed, rated 600 volt, for PVC insulated wire. No wire splices shall be buried.

2.5 MANUAL VALVES

- A. Manual valves 2 1/2" and smaller shall be all brass, globe type with composition disc rated at 150 pounds W.O.G.
- B. All valves shall have wheel handles unless cross handles are called for on the plan.

2.6 VALVE BOXES – AMATEK

- A. A box shall be provided for all valves.
- B. Valve boxes shall be made of high-strength plastic suitable for turf irrigation purposes.
- C. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve.
- D. Extension sections will be used as appropriate to the depth of piping.
- E. All valve box covers shall bolt down or have locking mechanisms and shall be colored black.

2.7 POP-UP SPRAY, MICRO SPRAY, ROTOR AND BUBBLER HEADS

- A. Pop-up spray, rotor and bubbler heads are specified on the drawings.

- B. Two bubbler head shall be provided per each tree at 2" caliper and larger and one bubbler head for each 1" caliper tree per locations as shown on the plans.
- C. Spray heads shall have a minimum 4" pop-up or 12" pop-up as designated on the drawings. The sprinkler body and all related parts shall be plastic cyclac or polycarbonate. They shall have a spring retraction for positive return action of the pop-up nozzle. The spring for retraction and the adjustable nozzle screw shall be made of corrosion resistant materials.
- D. All heads are to be operated and site adjusted to match precipitation rate of all heads in the zone with proper nozzle selection and arc adjustments.
- E. MICRO-SPRAYS -The nozzle shall be constructed of corrosion and UV-resistant plastic. The nozzle shall have a pop-up stem that when under water pressure, pops up an additional inch. It shall also have a stainless steel retraction spring to retract the stem when water pressure is released. The stem shall have an integral elastomeric flow bushing for maintaining a constant flow rate over the operating pressure range of 25 to 60 PSI (1.7 to 4.1 bars; 172 to 413 kPa). The nozzle shall be protected from debris by a stainless steel screen that is integral to the pop-up stem. The nozzle shall have standard female threads that are compatible with the threaded riser on Hunter spray heads as well as some other manufacturer's spray heads. The nozzle shall carry a two-year, exchange warranty (not prorated). Must be installed in Institutional spray body.

2.8 DRIP IRRIGATION

- A. The dripperline shall be Techline CV as manufactured by Netafim Irrigation, Inc. Dripper flow rate and spacing shall be as indicated on drawings.
- B. Soil Staples (TLS6): All on-surface/under mulch Techline CV/Techline Techlite installations shall be held in place with Techline Soil Staples spaced evenly every 3' to 5' on center, and with two staples on each change of location.
- C. Line Flushing Valves: All Techline/Techlite systems shall be installed with Netafim Automatic Line Flushing Valves as indicated on drawings. Techline CV zones do not require an automatic line flushing valve but must have a manual flushing port(s) in the position that an automatic flush valve would be positioned.
- D. Pressure Regulator: A pressure regulator shall be installed at each zone valve or on the main line to ensure operating pressures do not exceed system requirements. The pressure regulator shall be a Netafim Pressure Regulator.
- E. Disc Filter: A disc filter shall be installed at each zone valve or on the main line to ensure proper filtration. The filter shall be a Netafim Disc Filter. Model number and mesh as indicated on drawings.

2.9 ELECTRIC CONTROLLER (PERMANENT IRRIGATION)

- A. Electric irrigation controller shall be capable of operating the number of stations as indicated on the drawings. The system is designed to operate only one section valve at a time, unless otherwise noted. The controller will be specified on the irrigation plan.
- B. Power source shall be standard 117± volt 60 Cycle AC. Output for operation of companion solenoid actuated valves shall be 24 volts 60 Cycle AC.
- C. Operation of the controller shall be full automatic, incorporating one 24 hour clock and 14 day calendar per controlled number of electric valves shown on the plan to start the sprinkling cycle any hour or hours of the day or night of any day or days over a repeating 14 day period.
- D. The controller shall be capable of repeating watering cycles as required with a maximum delay between the ending of one cycle and the beginning of the next not to exceed 2 hours. Control

shall provide optional semi-automatic operation whereby the automatic cycle may be started independent of the clock and manual operation whereby any station may be operated by hand independent of all timing mechanism. The choice of automatic day or hour programming shall be available to the operator on the face of the control panel without the use of tools.

- E. The automatic controller shall be equipped with rainproof housing.
- F. Provide automatic rain/freeze shutoff with controller.

2.10 BATTERY OPERATED CONTROLLER (TEMPORARY IRRIGATION)

- A. The controller shall resist moisture intrusion and be waterproof to a depth of 12 feet. It shall operate for one full year on a 9-volt alkaline battery. The controller shall have 9 daily start times available and run times available from 0 to 240 minutes in 1-minute increments. The controller shall have a weekly 7-day schedule that allows user to choose day(s) of week for desired watering or an optional 31-day interval schedule. The controller shall be capable of manual operation and shall have a programmable rain delay of between 1 and 7 days. All programming shall be accomplished by use of selection buttons with user feed back provided by a LCD display. Program backup shall be provided by a non-volatile memory circuit that will hold the program data indefinitely. The controller shall have a rubber cover that attaches over the display area and shall be compatible with micro-switch based weather sensors.
- B. The SVC battery-operated controller shall consist of a programming module that is pre-wired to a DC latching solenoid. The programming module shall attach to the valve by a solenoid adapter. The DC latching solenoid supplied shall screw into and operate any Hunter PGV, HPV, SRV and ICV valve. The controller shall activate a single valve zone by way of the latching solenoid. The SVC shall also be available pre-attached to a PGV 1-inch, globe valve with flow-control and either Female Pipe Threads or BSP threads.
- C. The controller shall be installed in accordance with the manufacturer's published instructions. The controller shall carry a conditional two year exchange warranty. The automatic controller(s) shall be the SVC single-station series, as manufactured for Hunter Industries Incorporated, San Marcos, California.

2.11 ELECTRIC REMOTE CONTROL GLOBE VALVES

- A. Electric remote control valves shall have plastic bodies and covers and shall be globe-type diaphragm valves of normally closed design.
- B. Commissioning requires the participation of this Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the Division 1 Section 01810 referenced above. This Contractor shall be familiar with all parts of the Commissioning Section and the commissioning plan issued by the Commissioning Coordinator and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
- C. A flow stem adjustment shall be included in each valve.

2.12 BACKFLOW PREVENTER

- A. A double-check assembly shall be located and sized as shown on the plans.
- B. This assembly shall be installed in a box and shall conform to the City Plumbing Codes.
- C. Use Rectangle Jumbo Plastic Amatek box.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Design Pressure: This irrigation system has been designed to operate with a minimum static inlet water pressure as indicated on the drawing. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is 5% less than above, the Contractor shall notify the Owner's Representative.
- B. Contractor Responsibility: The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or water pressure exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the Owner's Representative in writing. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.
- C. Staking: Before installation is started, place a stake or flag where each sprinkler is to be located, in accordance with drawing. Staking shall be approved by the Owner's Representative before proceeding.
- D. Piping Layout: Piping layout is diagrammatic. Route piping around existing trees and root zones in such a manner as to avoid damage to plantings. Where access is restricted, bore under large existing trees to avoid damage and exposure of the root system. Do not dig within the ball of newly planted trees or shrubs.
- E. In areas where trees are present, trenches will be adjusted on site to provide a minimum clearance of four times the trunk diameter of the tree (at its base) between any tree and any trench.
- F. All material and equipment shall be delivered to the Worksite in unbroken reels, cartons or other packaging to demonstrate that such material is new and of a quality and grade in keeping with the intent of these Specifications.
- G. Refer to plan details for drip installation.
- H. Spray heads and Rotor heads cannot be located closer than 4" of any sidewalk, driveway or foundation.

3.2 EXCAVATION AND TRENCHING

- A. The Contractor shall perform all excavation to the depth indicated in these Specifications and Contract drawings. The banks of trenches shall be kept as nearly vertical as practicable. Trenches shall be wide enough to allow a minimum of 4" between parallel pipelines or electrical wiring. Where rock excavation is required, or where stones are encountered in the bottom of the trench that would create a concentrated pressure on the pipe, the rock or stones shall be removed to a depth of six (6) inches minimum below the trench depth indicated. The over depth rock excavation and all excess trench excavation shall be backfilled with loose, moist earth or sand, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the trench bottom, such shall be removed to a depth and length required, and the trench backfilled to trench bottom grade as hereinafter specified, with course sand, fine gravel or other suitable material.
- B. Bottom of trench grade shall be continued past ground surface deviations to avoid air pockets and low collection points in the line. The minimum cover specifications shall govern regardless

of variations in ground surface profile and the occasional deeper excavation required at banks and other field conditions. Excavation shall be such that a uniform trench grade variation will occur in all cases where variations are necessary.

- C. Trench excavation shall comprise the satisfactory removal and disposition of all materials, and shall include all shoring and sheeting required to protect the excavation and to safeguard employees.
- D. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance back from edge of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted as directed by the Owner's Representative. When excavated material is of a rocky nature and the topsoil or any other layer of excavated material is suitable for pipe bedding and backfill in the vicinity of the pipe, such material shall be separately stockpiled for use in such bedding and pipe backfill operations, unless satisfactory imported material is used.
- E. All excavations and backfill shall be unclassified and covered in the basic bid. No additional compensation will be allowed for rock encountered.
- F. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original conditions in a manner acceptable to the Owner's Representative.

3.3 PIPE INSTALLATION

- A. Sprinkler Mains: Sprinkler mains are that portion of piping from water source to electric valves. This portion of piping is subject to surges since it is a closed portion of the sprinkler system. Sprinkler mains shall be installed in a trench with a minimum of 18 inches of cover.
- B. Lateral Piping: Lateral piping is that portion of piping from electrical valve to sprinkler heads. This portion of piping is not subject to surges since it is an "open end" portion of the sprinkler system. Lateral piping shall be installed in a trench with a minimum of 12 inches of cover.
- C. Remove lumber, rubbish, and rocks from trenches. Provide firm, uniform bearing for entire length of each pipeline to prevent uneven settlement. Wedging or blocking of pipe will not be permitted. Remove foreign matter or dirt from inside of pipe before welding, and keep piping clean during and after laying pipe.
- D. PVC pipe shall not be installed where there is water in the trench, nor shall PVC pipe be laid when temperature is 40 deg. F or below or when rain is imminent. PVC pipe will expand and contract as the temperature changes. Therefore, pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction.

3.4 PVC PIPE AND FITTING ASSEMBLY

- A. Solvent: Make solvent-welded joints following standards noted herein. Thoroughly clean pipe and fittings of dirt, dust, and moisture with an approved PVC primer before applying solvent.
- B. PVC to Metal Connection: Work metal connections first. Use a non-hardening pipe dope such as Permatex No. 2 or "Teflon" tape on threaded PVC to metal joints. Use only light wrench pressure.
- C. Threaded PVC Connections: Where required, use threaded PVC adapters into which pipe may be welded.

3.5 HYDROSTATIC TESTS

Pressure Test: After the pipe is laid, the joints completed, and the trench partially backfilled, leaving the joints exposed for examination, the newly laid piping or any valved section of main

pressure line piping shall, unless otherwise specified, be subjected for four hours to a hydrostatic pressure test of normal city water pressure. Each valve shall be opened and closed during the test. Enclosed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade, as necessary. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this pressure test shall be repeated until the test results are satisfactory. All replacement and repair shall be at contractor's cost.

3.6 CONTROL WIRE INSTALLATION

- A. All control wire less than 500 feet in length shall be continuous without splices or joints from the controller to the valves. Connections to the electric valves shall be made within 18 inches of the valve using connectors specified in Paragraph 2.4 of this section, unless otherwise approved by the Owner's Representative in writing.
- B. All control wires shall be installed at least 18 inches deep. Contractor shall obtain the Owner's Representative's approval for wire routing when installed in a separate ditch. Control wires may be installed in a common ditch with piping; however, wires must be installed a minimum of 4 inches below or to one side of piping.
- C. All wire passing under existing or future paving, sidewalk, construction, etc., shall be encased in PVC Schedule 40 conduit extending at least 2 feet beyond edges of paving, sidewalks, or construction.

3.7 POP-UP SPRAY, MICRO-SPRAY, ROTARY AND BUBBLER HEADS

- A. Provide heads and nozzles as specified and install in locations as shown on the Contract Drawings.
- B. Pop-up spray and micro-spray heads shall be installed on a "flex" pipe connector as detailed. Rotary heads shall be installed on a double swing joint connected to the lateral pipe. Bubbler shall be a tree well flexible riser-bubbler head on a flex pipe. Provide wire staple to secure the bubbler to the top of the root ball. Keep heads a minimum of 4 inches from paved surfaces.
- C. Heads shall be installed with underside of flange flush with the finished grade.
- D. Contractor will be required to adjust heads as necessary after establishment of grass or other plant material.

3.8 QUICK COUPLING VALVES

- A. Quick coupling valves shall be installed at 100 foot on center along mainline with a ball valve preceding the QC for shut off.
- B. Quick coupling valves shall be installed with the underside of flange flush with the finished grade.
- C. Quick coupling valves shall be installed on a swing joint assembly as detailed on the submitted and approved shop drawings.
- D. Under the warranty, the Contractor shall return after grass is established and adjust valves and valve boxes to proper grade.

3.9 MANUAL VALVES

- A. Manual valves shall be sized and located where shown on the Contract drawings.
- B. Valve boxes shall be adjusted to be flush with finished grade.

- C. Valve boxes shall be properly supported and of sufficient construction that tractors, mowers or other equipment crossing over the boxes will not push boxes down and crush the pipe, valve, or box.

3.10 VALVE AND VALVE BOX PLACEMENT

- A. A ball valve shall precede each valve to provide shut off for repair of valves.
- B. All manual, electric, and quick coupling valves shall be in boxes as specified in Paragraph 2.6 of this section, and shall be set with a minimum of six (6) inches of space between their top surface and the bottom of the valve box. The base of the box shall be filled with pea gravel per manufacturer's installation instructions.
- C. Valves shall be fully opened and fully closed to ensure that all parts are in operating condition.
- D. Valve boxes shall be set plumb, vertical, and concentric with the valve stem.
- E. Any valve box which has moved from this required position so as to prevent the use of the operating wheel of the valve shall be reset by the Contractor at his own expense.

3.11 ELECTRIC CONTROLLER

- A. Electric controller shall be located as shown on the plans and shall be capable of operating the number of stations indicated.
- B. The system is designed to operate only one section at a time, unless otherwise noted on the plans in strict accordance with the manufacturer's published installation instructions.

3.12 ELECTRIC REMOTE CONTROL VALVES

- A. Remote control valves shall be located and sized as shown on the plans. All electrical connections shall be made when the weather is dry with connection kits as specified in Paragraph 2.4 of this section in strict accordance with manufacturer's recommended procedures. All remote control valves shall be installed in a horizontal position, in accordance to the manufacturer's published installation instructions.
- B. It shall be the responsibility of the Contractor to furnish and install the proper size wire on each of the low voltage circuits from the master control center to the various electric remote control valves.
- C. Consideration shall be given to each circuit for allowance of voltage drop and economy consistent with accepted practices of electrical installation. Under no circumstances shall the voltage of any branch circuit be reduced more than proper due to length of run exceeding the maximum allowable for the wire size used.

3.13 BACKFILL AND COMPACTION

- A. After system is operating and required tests and inspections have been made, the trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, gravel, soft shale, or other approved materials, free from large clods of earth or stone. Rock, broken concrete, or pavement, and large boulders shall not be used as backfill material. The backfill shall be thoroughly compacted and evened with the adjacent soil level.
- B. Compact trenches in areas to be planted by thoroughly flooding the backfill. Compact all other areas by flooding or hand tamping. The jetting process may be used in areas when flooding.

- C. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to a minimum of 90% density.
- D. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for compaction, then refilled and compacted with the surface restored to the required grade and left in a completed surface condition as described above.
- E. Specifically tamp backfill under heads and around the flange of heads for one foot (1') by a suitable means after trench backfill has dried from flooding to prevent heads loosening in the ground.

3.14 FINAL ADJUSTMENT

- A. After installation has been completed, make final adjustment of sprinkler system prior to Owner's Representative's final inspection.
- B. Completely flush system to remove debris from lines by removing nozzle from heads on ends of lines and turning on system.
- C. Check sprinklers for proper operation and proper alignment for direction of throw.
- D. Check each new section for operating pressure and balance to other sections by use of flow adjustment on top of each valve.
- E. Check nozzling for proper coverage. Prevailing wind conditions may indicate that arc or angle of spray should be other than as shown on drawings. In this case, change nozzles to provide correct coverage and furnish record data to Owner's Representative with each change.
- F. After system is thoroughly flushed and ready for operation, each section of sprinklers shall be adjusted to control pressure at heads. Use the following method, one section at a time:
 - 1. Remove last head on section and install a temporary riser above grade. Install tee with pressure gauge attached on top of riser and re-install head with nipple onto tee.
 - 2. Correct operating pressure at last head of each section as follows: Spray Heads - 20-25 psi; rotor heads - 30 to 40 psi (and as recommended by the manufacturer).
 - 3. After replacing head, at grade, tamp thoroughly around head.

3.15 CLEAN-UP

- A. The Worksite shall be thoroughly cleaned of all waste materials and all unused or salvaged materials, equipment, tools, etc.
- B. After completion of the work, areas disturbed shall be leveled and the Worksite shall be raked clean and left in an orderly condition.

3.16 TEMPORARY IRRIGATION FOR GRASS ESTABLISHMENT

The contractor shall provide temporary irrigation for all new turf areas. Temporary irrigation may include equipment securely staked above grade. It shall be the contractor's responsibility to provide complete, consistent temporary coverage in order to establish a viable, mowable stand of grass. Any above grade equipment shall be removed by the contractor upon acceptance of the turf by the owner.

PART 4 - METHOD OF MEASUREMENT

MEASUREMENT:

Landscape Irrigation Systems described in this section will be paid for on a lump sum basis wherein no measurement will be made.

PART 5 BASIS OF PAYMENT

PAYMENT:

- A. Landscape Irrigation Systems will be paid for at the Contract lump sum, which price will be full compensation for furnishing and installing equipment; shop drawings; providing all submittals and warranties; furnishing all labor, materials, tools, equipment; and incidentals necessary to complete the work as described in this section and related other sections of these Specifications and plans, as well as maintenance until final acceptance.

- B. Payment will be made under:

<u>Number</u>	<u>Pay Item</u>	<u>Pay Unit</u>
02975 - 1	Landscape Irrigation System	Lump Sum

END OF SECTION 328400

SECTION 32 8410

IRRIGATION PUMP SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mechanical, plumbing, electrical systems and related accessories for proper construction of irrigation pump system.
 - 2. Connection to utilities.

1.2 INCLUDED SECTIONS

- A. Pump Station(s)

1.3 RELATED SECTIONS

- A. Refer to Architectural documents
- B. Refer to Civil documents
- C. Refer to Electrical documents
- D. Refer to Irrigation documents
- E. Refer to Landscape documents
- F. Refer to Mechanical documents

1.4 REFERENCES

Materials and installation must be in compliance with applicable provisions of the latest edition of the following codes and standard specifications, as well as any other applicable codes and regulations set by jurisdictional authorities.

- A. NEC National Electrical Code
- B. NFPA National Fire Protection Association
- C. UBC Uniform Building Code
- D. UPC Uniform Plumbing Code
- E. ASTM American Society for Testing and Materials
- F. ANSI American National Standards Institute
- G. ASME American Society of Mechanical Engineering
- H. ASSE American Society of Sanitary Engineering
- I. AWWA American Water Works Association
- J. CS Commercial Standards
- K. NEMA National Electrical Manufacturers Association
- L. NSF National Sanitation Foundation
- M. AASHTO American Association of State Highway and Transportation Officials
- N. UL Underwriters Laboratories, Inc.

1.5 SUBMITTALS

- A. Product Data: Include material list, manufacturer's data sheets, and installation instructions for each component and material. Specify and mark all details and options that will be provided, and cross reference to the material schedule.
- B. Shop drawings for the following equipment showing plans and elevations shall be supplied:
 - 1. Layout of equipment areas, pipe and conduit runs, fitting and fixture locations, pipe elevations, and

- dimensions between pipe center lines.
- 2. Wiring Diagram of control system.
- 3. Dimensioned outline drawings of pump station(s) and electrical control panel(s).
- 4. Connection to irrigation system.
- 5. Drawings signed and sealed by licensed professional.
- 6. Shop drawings shall also be provided for all custom fabrications.
- 7. Shop drawings shall be coordinated with other trades prior to submittal.
- 8. Power source requirements and connection to electrical.
- C. Closeout Submittals:
 - 1. Operation and Maintenance Data: Include information required for operation and maintenance of irrigation pump system.
 - 2. Record drawings shall be submitted prior to final acceptance.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Minimum 5 years documented experience in work of this Section.
 - 2. Successful completion of min. 3 projects of similar scope and complexity within past 5 years.
 - 3. Include list of completed work, work in progress, and references.
- B. When the specifications and drawings call for described materials, workmanship, or construction of a better quality, higher standard or larger size than is required for the above-mentioned rules and regulations, the provisions of these specifications and drawings shall take precedence over the requirements of said rules and regulations.
- C. Furnish, without extra charge, any additional material or labor required for compliance with these rules and regulations, although not mentioned in these specifications or indicated on the drawings.
- D. Control Panel(s) UL labeled – Industrial Control Panel.
- E. Electrical components shall be UL listed for conformance to US standards.
- F. Prefabricated pump assembly shall be hydrostatically factory tested.
- G. All components to be in compliance with local codes.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Protective covers, coatings and shipping material shall be retained to protect equipment from damage during shipment, delivery and storage.
- B. Protect electrical components against weather and contact with moisture from time of delivery through time of installation. Store and handle equipment as needed to protect against damage from weather, dust, dirt, construction traffic and other causes.
- C. Follow manufacturer's instructions for system delivery, storage and handling.

1.8 PROJECT CONDITIONS

- A. Do not install pump station(s), electrical control panel(s) where ground water or other site conditions do not comply with manufacturer's recommendations.

1.9 COORDINATION

- A. Any required backfill, anchoring, concrete foundations, dimensions, location and reinforcement shall be coordinated based on manufacturer's recommendations.
- B. Any required electrical power supply capacity and location shall be coordinated with Project Electrical Engineer and based on system demand, manufacturer's recommendations and comply with all local building codes.
- C. Any required pressure pipe or DWV plumbing capacity and location shall be coordinated based on manufacturer's recommendations and comply with all local building codes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Pump Station(s) and Control Panel(s): Are based on products by inCon-trol Water Systems, 410 Interchange, McKinney, TX 75071, 214-733-8828 (www.incontrolwatersystems.com).
- B. Substitutions: Not permitted.

2.2 PUMP STATION

- A. As manufactured by inCon-trol Water Systems, 410 Interchange, McKinney, TX 75071, 214-733-8828.
 - 1. Information below is provided for reference as to state the quality of the end product desired by the owner.
 - 2. Pump station(s) shall be a pre-manufactured skid mounted product. No individual components assembled in the field other than required connections to pre-manufactured pumping station will be allowed.
- B. Refer to design document for performance requirements.
- C. Pipe and Fittings:
 - 1. General: Identified on pipe by manufacturer indicating material, class or type, and pressure rating.
 - 2. PVC:
 - a. Pipe: Schedule 80 – ASTM D2464, Class 200 – ASTM D2241
 - b. Fittings: Schedule 80 – ASTM D2467. “Low Pressure” fittings are not acceptable.
 - 3. HDPE: Pipe and fittings shall be made from resin meeting the requirements of the Plastic Pipe Institute a PE3408. The resin shall meet the requirements of ASTM D3350-02 with cell classification of 345464C.
 - a. Pipe: AWWA C901 or C906, NSF Standard #61 and ASTM standards.
 - b. Fittings: AWWA C901 for sizes 1/2" to 2" and AWWA C906 for sizes 3" to 54".
 - 4. Copper:
 - a. Pipe: ASTM B88, drawn temper for solder type fittings, dead soft for use with compression type fittings.
 - b. Fittings:
 - 1. Wrought copper or cast bronze, ASTM B75 and ANSI B16.22.
 - 2. Brass compression fittings for copper tube: SAE CA377 and SAE CA 360.
 - 5. Steel:
 - a. Pipe: Constructed from ASTM A120, ASTM A53, or API 5L steel pipe. Piping 6" in diameter or smaller shall be constructed from schedule 40 steel pipe or heavier and piping 8" and larger shall be constructed of schedule 40 pipe or heavier.
 - b. Fittings:
 - 1. Welded fittings, ANSI B16.9, ASTM A234 and shall be schedule 40 or heavier.
 - 2. Flanged fittings, ANSI B16.5, ASTM A181 and A105 and shall be 150 lb.
- D. Thrust Blocks: Concrete, minimum 3000 psi compressive strength at 28 days.
- E. Pumps: As specified on the plans.
- F. Valves:
 - 1. PVC:
 - a. Schedule 80 true union ball valves; slip and threaded.
 - 2. Bronze:
 - a. Threaded gate valve; deep thread for steel pipe.
 - b. Threaded center line check valve; 2 inch pipe and smaller.
 - c. Threaded ball valve.

- d. Air relief valve.
 - e. Pressure regulating valve.
- 3. Steel:
 - a. Lug style butterfly valve.
 - b. Flanged gate valve.
 - c. Flanged and wafer foot valve; check valve.
 - d. Swing style; no center line check valves.
 - e. Air relief valve.
- G. Flanged and Mechanical Joint Adapters: Shall be PE 3408 HDPE, Cell classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- H. Filter:
 - 1. Self-cleaning type with automatic backwash.
 - 2. Sized to accommodate specified flow rate and pressure.
- I. Pump Station(s) Enclosure: As manufactured by inCon-trol Water System.
 - 1. Refer to design document for dimensions, material, and finish.
- J. Control Panel(s): As manufactured by inCon-trol Water Systems; must be UL 508A labeled.
- K. Conduit
 - 1. Within equipment enclosures: EMT, Flexible – (Sealtight).
 - 2. Buried or completely encased in concrete: PVC Schedule 40.
- L. Wire
 - 1. Copper, 600 volt insulation, stranded for wire larger than 8 AWG, stranded for smaller wire. Do not use wire smaller than 12 AWG for power.
 - a. Types: THWN, THHN.
- M. Level Controls: As manufactured by inCon-trol Water Systems.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install irrigation pump station(s) in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Conceal piping and conduit unless otherwise indicated. Arrange exposed piping in neat, straight lines parallel or perpendicular to other construction. Brace all piping on above ground installations.
- C. Cut piping and conduit to fit without forcing or bending. Remove burs and rough edges. Follow manufactures recommendations for solvent weld and/or any other pipe materials specified.
- D. Bend piping and conduit to prevent damage and reduction of inside diameter. Do not place more than two 90 degree bends on single runs between accessible points.
- E. Arrange equipment so that elements requiring removal or maintenance are readily accessible without disturbing other components. Provide clear passage between components.
- F. Brace equipment and piping to maintain locations and minimize vibration.

- G. Seal open pipe and conduit ends to prevent entrance of dirt, debris, and water.
- H. Protect pipes, conduits, and equipment from damage from inclement weather.

3.2 INSTALLATION – PLUMBING

- A. Install piping without loops and traps. For below grade installations, pipe shall also be properly bedded with sand or crushed aggregate.
- B. Make provisions for thermal expansion and contraction of piping.
- C. Provide flanges or unions to allow for removal and reinstallation of equipment without cutting.
- D. Install butterfly valves on suction lines for isolation purposes only. Use eccentric reducers to prevent trapping air in line.
- E. Provide butterfly, gate, globe, ball, plug, or other infinitely adjustable valves in discharge lines.
- F. Install P-traps on drains when required by Code.
- G. Underground piping:
 - 1. Trench for underground piping to provide sufficient slope and adequate space to allow for pipe installation.
 - 2. Install thrust blocks on pipe 2-1/2 inches in diameter and larger at directional changes, reducers, and line terminations.
 - 3. Backfill in maximum 6 inch lifts; compact each lift to minimum 95 percent maximum density.
- H. Penetrations:
 - 1. Make penetrations only at locations indicated unless otherwise approved.
 - 2. Provide core-drilled holes, with Link-Seal, passing through concrete wall, floor, or roof assemblies.
 - 3. Waterstop penetrations in exterior assemblies.

3.3 INSTALLATION – ELECTRICAL

- A. All electrical components shall be installed by a licensed electrical contractor, and in accordance with manufacture's requirements, and within required state and local codes.
- B. The general contractor will supply a dedicated power source as shown on the plans for the irrigation pump station(s) and associated components' operation.
- C. The electrical contractor will install wire and conduit between the owner's power source and the pump control panel location.
- D. Install wiring in sealed conduits.
- E. Install dielectric fittings on connections between dissimilar conduit types and seal with dielectric thread compound.
- F. Do not use threadless connectors for conduit.
- G. Provide bushings where conduit enters boxes or fittings.
- H. Provide accessible covers at junctions, bends, and offsets on exposed conduit runs.

- I. Do not use threadless couplings or connectors on conduit in wet locations or where buried. Make joints using tapered pipe threads sealed with Teflon tape or sealant.
- J. Install conduit entering control panels at bottom of panel.
- K. All hardware and metal shall meet or exceed NEC requirements for bonding and GFIC.
- L. Underwater Junction Boxes:
 - 1. Fill boxes with approved potting compound.
 - 2. Prior to installing potting compound, make final connections and perform required testing.
- M. Wiring:
 - 1. Remove moisture and debris from conduit prior to installation of wiring.
 - 2. Do not install damaged wiring.
 - 3. Make connections to equipment susceptible to vibration or noise using flexible watertight conduit.
 - 4. Use THWN stranded wire in conduits between irrigation pump station(s) and control panel(s).
 - 5. Neatly group and distribute wiring.
 - 6. Use stranded copper wiring between with waterproof insulation between underwater equipment and control panels.
- N. Seal conduits after wiring installation.
- O. Cover conduit exposed to moisture with watertight plastic and make joints using watertight fittings.

3.4 INSTALLATION– PUMP STATION

- A. Equipment skid shall be securely anchored, using electro-galvanized hardware.
- B. Concrete pad:
 - 1. Reinforced, 3000 psi compressive strength at 28 days.
 - 2. Sub-grade: compacted to 95%
 - 3. Vapor Barrier: 10 mil polyethylene sheet, type recommended for below-grade application and compatible waterproof tape.
 - 4. Medium broom finish

3.5 TESTING / ADJUSTING

- A. Plumbing:
 - 1. Clean systems of debris prior to testing.
 - 2. 24 hours prior to backfilling and concreting, hydrostatically test completed system to system's maximum operating pressure. Do not include equipment that is not rated for or could be damaged as result of pressure in test.
 - 3. Perform test in presence of Owner or Owner's Representative.
 - 4. System shall withstand pressure testing without pressure loss and leaks during test.
 - 5. Repair or replace defective piping and components prior to concreting or backfilling, and retest to same requirements until acceptable results are achieved.
 - 6. Maintain pressure during backfilling or perform additional pressure testing after backfill is completed to ensure that damage has occurred during backfilling.
 - 7. Conduct any other plumbing tests as required by governing authorities.
 - 8. All equipment to show that it complies with specified requirements.
 - 9. Irrigation Contractor shall be responsible for flushing irrigation lines prior to connection to irrigation pump station(s).
- B. Conduct electrical tests as required by governing authorities.

- C. As soon as the pump station(s) & pipe systems have been installed and tested, and the mechanical and electrical equipment have been installed and tested, the equipment shall be considered as placed into operation.
- D. An authorized service technician from the pump equipment supplier shall provide the startup & calibration for the water pump equipment.
- E. Make adjustments required for proper operation of irrigation pump system.
- F. After system has been placed into operation, installing contractor and owner or owner's representative shall determine the water make up rates and whether such rates are normal and not a sign of leakage from system. If necessary, a water meter shall be placed on the makeup water line to document makeup rates.

3.6 DEMONSTRATION

- A. Demonstrate operation and maintenance of all components and aspects of rainwater harvesting/storm water detention system to Owner or Owner's Representative. At this time, provide Owner or Owner's Representative with any specialty tools required for the maintenance of the irrigation pump system.

3.7 PUMP STATION EQUIPMENT SCHEDULE

- A. Reference design documents for Pump Station(s) Schedule.

PART 4 WARRANTY

4.1 SCOPE

System integrator shall maintain a factory trained and managed network of service technicians to execute all field service and warranty claims. System Integrator shall provide technical support by telephone to the installer and owner both during and after the warranty period.

4.2 WARRANTY

Manufacturer / Integrator shall warrant that fully integrated rainwater harvesting/storm water detention system to be free of manufacturer's defects for a period of one year. Provided installation and operation have been properly performed, Manufacturer / Integrator shall bear the cost of parts and labor necessary to repair or replace the defective component during the warranty period. Unauthorized repairs or replacements performed by non- Manufacturer / Integrator personnel may void the warranty.

END OF SECTION 328410

SECTION 329100

SOILS

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section specifies all soil materials designated as "Planting Mix", on the drawings or in the Specifications.

1.2 REFERENCES:

- A. Related Work Specified elsewhere
 - 1. Section 329200 – Turf and Grasses
 - 2. Section 329200.1 – Field Turf and Grasses

1.3 SUMMARY

- A. Section Includes
 - 1. Improved Top Soil
 - 2. Turf Soil

1.4 DEFINITIONS

- A. CFR: Code of Federal Regulations
- B. Clopyralid: Herbicide used to control broadleaf weed.
- C. Compost: a stable humus material created by combining organic wastes (e.g. yard trimmings, food wastes, manures) in proper ratios into piles, rows, or vessels; controlling temperature, moisture and oxygen to achieve accelerated decomposition; and adding bulking agents (e.g. wood chips), as necessary, to provide air space; allowing the finished material to fully stabilize and mature through a curing period.
- D. pH: A measure of the soil acidity or Soil alkalinity. An acid solution has a pH value less than 7, while a basic solution always has a pH larger than 7. The pH can affect the availability of nutrients in the soil.
- E. pH Balanced Compost: A combination of fully composted cotton burrs and local landscape trimmings such as grass, leaves and brush. Has a balanced pH between 5.5-6.5 and a Solvita® Compost Maturity Index Value of 7 or higher; and adds an average of 1.44 pounds of (N) Nitrogen, .22 pounds of (P) Phosphorus and .9 pounds of (K) Potassium.
- F. Picloram: Herbicide used to control woody plant material such as trees and shrubs.
- G. Professional Compost: A combination of fully composted landscape trimmings such as grass, leaves, brush, and wood chips. Has a Solvita® Compost Maturity Index Value of 7 or higher; and adds an average of 1.1 pounds of (N) Nitrogen, .13 pounds of (P) Phosphorus and .8 pounds of (K) Potassium.
- H. Solvita® Maturity Test: A diagnostic test that measures the amount of Carbon Dioxide and Ammonia present in compost.

- I. Screened Planting Soil: Very fine existing, native surface topsoil screened to keep soils open.
- J. Screened Sharp Sand: Deep sand that is excavated from a minimum of 20 feet below ground level, minimizing the chances of nut sedge and traces of other noxious weed and grass seed, screened to keep sand open.
- K. TCEQ: Texas Commission on Environmental Quality
- L. Washed Concrete Sand: Coarse sand that has been washed clean of clay, silt, and weed seed, and has been screened for consistency.

1.5 SUBMITTALS

- A. Submittal to be sent to Owner for approval 30 days before purchasing and delivery to site.
- B. Product Data: For each type of product indicated.
- C. Product Certificates: Showing soil analysis from a qualified soil-testing laboratory.
- D. Samples: To be submitted with the following conditions and items
 - 1. Representative samples of material shall be provided to the Owner from the supply source.
 - 2. 1 gallon of material to be provided in a clear, re-sealable, plastic bag.
 - 3. Product Certificate

1.6 QUALITY ASSURANCE

- A. Soil Analysis: For each soil type, furnish soil analysis and a written report by a qualified soil test laboratory.
 - 1. The soil-testing laboratory shall oversee soil sampling
 - 2. Report suitability of tested soil for plant growth.
 - a. Recommendations for nitrogen, phosphorus, and potassium and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective actions.
- B. Soil Testing Laboratory: Subject to compliance with requirements, Laboratories that may be incorporated into the work include, but are not limited to:
 - 1. Ana-Lab Corp: Arlington, Texas at (817) 917-9216
 - 2. Xenco Labs: Dallas, Texas at (214) 902-0300

1.7 DELIVERY

- A. Do not dump or store materials near structures, utilities, walkways and pavements, or on existing turf areas or plants
- B. Provide erosion-control measures to prevent erosion or displacement of materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways
- C. Accompany each delivery of material with appropriate certificates.

PART 2 – PRODUCTS

2.1 MANUFACTURES

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to:

1. Soil Building Systems
2. Living Earth Technology

2.2 IMPROVED TOP SOIL

- A. A pre-mixed soil created as a low-level organic planting medium to provide maximum plant growing results, without significant settling over time.
- B. pH: 7.5 – 8.7
- C. Particle Sizes: 98.5% pass through a ½" screen. 99% will pass through a ¾" screen.
- D. Color: Light to medium brown.
- E. Weight: 2000 – 2200 lbs. per cubic yard
- F. Free of: Contains no treated or used lumber, pine bark, man made chemicals, raw manure, or spent mushroom compost waste. Also there are not trace elements of the herbicides Clopyralid or Picloram.
- G. Composition Ratios: 25% Professional Compost, 25% Screened Planting Soil , and 25% Screened Sharp Sand

2.3 LANDSCAPE BED SOIL

- A. A soil that is pre-mixed in optimum proportions with soil amendments to create a medium for maximum growing results of routine plants.
- B. pH: 6.5 – 7.6
- C. Particle Sizes: 98.5% pass through a ½" screen. 99% will pass through a ¾" screen.
- D. Color: Medium brown
- E. Weight: 1900 – 2250 lbs. per cubic yard
- F. Free of: Contains no treated or used lumber, pallets, pine bark, man made chemicals, raw manure, or spent mushroom compost waste. Also there are not trace elements of the herbicides Clopyralid or Picloram.
- G. Ratios: 50% Balanced Compost, 25% Screened Planting Soil , and 25% Screened Sharp Sand

2.4 TURF SOIL

- A. A very loose textured soil created to settle minimally over time with an exceptional percolation capacity, yet will retain enough moisture to adequately supply the vegetation.
- B. pH: 7.4 – 8.3
- C. Particle Sizes: 98.5% pass through a ½" screen. 99% will pass through a ¾" screen.
- D. Color: Medium Tan.

- E. Weight: 2000 – 2200 lbs. per cubic yard
- F. Free of: Contains no treated or used lumber, pine bark, man made chemicals, raw manure, or spent mushroom compost waste.
- G. Composition Ratios: 25% pH Balanced Compost, 75% Washed Concrete Sand.

2.5 ADDITIONAL SOIL INFORMATION

- A. Meet or exceed the time and temperature standards set in TCEQ., Chapter 332, Subchapter B, Part 23.
- B. Meet federal Specifications under guidelines of 40 CFR, Part 503, Standards for Class A Bio-solids.
- C. Have a high concentration of aerobic composted organic matter as determined by ASTM D-5268 at 824°F.

PART 3 – EXECUTION

3.1 GENERAL:

- A. This part shall include the placing of all specified soil at the locations and elevations as shown.
- B. Soil mixes shall be mixed in proportions as specified for each soil mix. Thoroughly blend mix to a consistency relatively free of clods, at depth specified or as indicated on drawings.
- C. Use an extensive aerobic composting process that includes
 - 1. Scheduled turns with a minimum of 5 turns.
 - 2. Completely composted for a minimum of 6 to 12 months
- D. The work performed herewith, shall conform in every respect to the Contract Documents, the applicable local ordinances and sanitary codes, the regulations of the State Health Department, the regulations of the Occupational Safety and Hazardous Administration (OSHA) and the regulations of the Environmental Protection Agency (EPA). In the event that the contract documents do not adequately specify materials, methods of construction or workmanship of any portion of the proposed work, the Standards of the Trade shall govern.

3.2 CLEANING, REMOVAL, AND REPAIR

- A. Promptly remove materials spilled on pavement adjacent to plant areas. Repair existing lawns damaged by operations under this contract. Repair shall include finish grading and seeding, or turf, as required to match existing grade and lawn, and maintenance of repaired areas.
- B. Waste or excess material to be placed or disposed of as directed by OWNER.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT:

- A. Soil for the work shown on the plans shall be measured by the cubic yard

4.2 PAYMENT:

- A. The accepted quantities of Soil shall be paid for at the unit bid price per cubic yard.
- B. The unit bid price shall be full compensation for furnishing, hauling, and mixing soils; and for all equipment and incidentals necessary to complete work.
- C. The preceding provisions for payment shall not be interpreted to provide payment for soil used for backfill operations or other soils needed to complete construction for which provision is otherwise made in the contract.

END OF SECTION 329100

SECTION 329200
TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.

1.2 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.

1. Certification of each seed mixture for turfgrass.
- C. Product certificates.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
1. Pesticide Applicator: State licensed, commercial.
- B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
1. The soil-testing laboratory shall oversee soil sampling.
 2. Report suitability of tested soil for turf growth.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.6 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 2. Sodded Turf: 30 days from date of planting completion.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species. Reference drawings.

2.2 ORGANIC SOIL AMENDMENTS

- A. Turf Soil: Reference Section 329100

2.3 FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.4 PLANTING SOILS

- A. Turf Soil: Reference Section 329100

2.5 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

2.6 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.

2. Apply 2-inch layer of Turf Soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil with existing soil.
 3. After blending operations are complete apply 1-inch finish layer of Turf Soil.
 4. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer directly to surface soil before loosening.
 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. For Bermuda Hydromulch, sow seed at a total rate of 1 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- E. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.3 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches .
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION 329200

SECTION 32 9200.1

FIELD TURF AND GRASSES

PART I -GENERAL

1.01 SUMMARY

A. Work included:

1. Lawn work shall include sodding operations through the one-year warranty period and 60-day maintenance as indicated on plans and specified herein.
2. Provide all labor, materials, and equipment necessary to perform the sodding work, complete, as indicated on the Drawings and as specified.
3. Consult with a turf grass specialist approved by the landscape architect. Specialist shall have a minimum of 5 years of experience in the Houston area. Specialist shall have managed or maintained at least 5 installations of this type, size, and complexity in the last five years.

1.02 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):D 1557 Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 kg) Hammer and 18 in. (457mm) Drop.

1.03 SUBMITTALS

A. Samples and Product Information: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source being used:

1. Sod type (Tifway 419), growing conditions, and certification.
2. Fertilizer specifications and guaranteed analysis.
3. Top soil chemical analysis and manufacturer.

B. Construction Schedule: At least two weeks prior to start of work, submit sodding schedule.

C. Maintenance: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the turf for an entire year. Submit prior to Notice of Substantial Completion.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications

1. The work of this section shall be performed by a Contractor specializing in athletic field sodding installations.

2. The Contractor shall have successfully completed at least 5 installations of this type, size, and complexity in the last five years.
- B. Lawn materials shall comply with all government regulations prevailing at the supply source and the job site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod

1. Do not dig sod at the nursery or other approved source until ready to transport sod to the project site or approved storage location.
2. Before stripping, sod shall be mowed at a maximum uniform height of $\frac{3}{4}$ ".
3. Cut sod to be rolled in long rolls, $\frac{1}{2}$ " thick and to standard width and length desired.

B. Transporting Sod

1. Sod transported to the Project in open vehicles shall be covered with tarps or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.
2. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or in temporary storage.
3. Upon arrival at the temporary storage location or the site of the work, sod shall be inspected for proper shipping procedures. Should the roots be dried out, the Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall remove it at once from the area of the work and replace it.
4. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of sod. A legible copy of the invoice, showing species and variety of sod included for each shipment shall be submitted to the Landscape Architect. Certificate of Inspection when required must accompany each sod shipment.

C. Handling and Storage of Sod

1. No sod shall remain in temporary storage over 24 hours.
2. Sod shall be kept moist and shall be stored in a compact group to prevent drying out or freezing.
3. Contractor shall take care in the handling of sod material to avoid breaking or tearing strips. Sod that has been damaged by poor handling may be rejected by the Landscape Architect.

1.07 JOB CONDITIONS

- A. Do not install seed or sod on saturated or frozen soil.
- B. Sod installation shall be subject to suitability of the weather and other conditions affecting sod growth.
- C. Planting season may be extended only with the written permission of the Landscape Architect.

1.08 GUARANTEE

- A. Warrant all turf grass for a period of one year from date of Notice of Substantial Completion, to be at least the quality and conditions as at Final Acceptance. Promptly resod unacceptable areas during the warranty period as directed by the Landscape Architect.
- B. Lawn shall be uniform in color, grass type, leaf texture, leaf and root density, and free from weeds, diseases, and other visible imperfections at acceptance.
- C. Guarantee does not cover damage as a result of fertilizers, pesticides, or other applications not supervised by the Contractor or as a result of acts of God or vandalism.

1.09 ACCEPTANCE

- A. The Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
- B. Acceptance will be based on establishment of a uniform stand of turfgrass, defined as coverage of specified grass at a density of 95 percent coverage, with no bare spots greater than one square foot, free of weeds, undesirable grass species, disease, and insects. For grass varieties selected, allow a minimum of 90 days for establishment and maintenance of an acceptable stand of grass.
- C. In areas that are grassed and not irrigated. An acceptable stand of grass shall be established and the Landscape Architect will inspect the work for Substantial Completion upon written request of the Contractor.
- D. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect will recommend to the Owner that the work of this Section be accepted.

PART 2 - MATERIALS

2.01 SPRIG

- A. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and any attached roots free of soil, of the following turfgrass species:
- B.

2.02 SOD

- A. Sod shall be certified nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully and otherwise maintained from planting to harvest.
- B. Sod shall be of species indicated.
- C. Thickness of Cut: Sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2" on width and plus or minus 5% on length. Broken strips and torn or uneven ends will not be accepted.
- D. Strength of Sod Strips: Sod strips shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
- E. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively wet or dry) may adversely affect its survival.
- F. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 24 hour period unless a suitable preservation method is approved by the Landscape Architect prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Landscape Architect prior to its installation.
- G. Thatch: Sod shall be relatively free of thatch. A maximum of 1/4" (uncompressed) thatch will be permitted.
- H. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil borne insects.
- 1. Weeds: Sod shall be free of objectionable grassy and broadleaf weeds.

2.02 FERTILIZER

- A. Fertilizer shall be a complete fertilizer, part of the elements of which is derived from organic sources. The percentages by weight shall be a minimum of 15-15-15, also containing 10-15% sulphate & traces of iron & zinc as approved by owner.

PART 3 -EXECUTION

3.01 PREPARATION

- A. Grade Preparation
 - 1. Immediately before seeding or sodding, scarify, loosen, float and drag the upper 1-2 inches of topsoil to bring it to the proper condition. Remove foreign matter larger than 1/2" in diameter.
 - 2. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drag with a weighted spike harrow or float drag. The required result shall be the elimination of ruts or depressions that would cause water to stand or pond immediately after rainfall or operation of the lawn irrigation system, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting. See Section 31 22 00.1 Baseball Field Grading.

3. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the surface to specified condition.

B. Fertilizing

1. Uniformly distribute fertilizer by mechanical means at the rate of 12 pounds per 1,000 square feet.
2. If applying a fertilizer with a percentage by weight not as specified, apply at the rate of 2 pounds actual nitrogen per 1,000 square feet.
3. Work fertilizer into the soil after fine grading & not more than 2 days prior to grass planting. Cultivating equipment shall be set so the fertilizer will not penetrate into the soil more than 1 inch. Do not apply fertilizer when there is a possibility of rain before lawn areas can be seeded or sodded.

3.02 SPREADING OF TOPSOIL

A. Topsoil and subgrade shall be damp when topsoil is spread.

B. Areas to be seeded or sodded shall be topsoiled to a minimum depth of 4 in., compacted measure. Provide additional topsoil depths as required to construct the grades indicated on the Drawings. Topsoil shall be compacted to recommendations of turf supplier. Topsoil shall be as follows:

1. Natural, fertile, friable agricultural soil, having characteristics of representative productive soils in the vicinity, and obtained from naturally well-drained areas.
2. Topsoil shall not be excessively acid or alkaline nor contain toxic substances.
3. Topsoil shall be without admixture of subsoil and shall be reasonably free from clay lumps, stones, stumps, roots, live plants, or similar substances one inch or more in diameter, debris, or other objects which might be a hindrance to planting operations.

3.03 SPRIGGING

A. Weather Conditions

1. Schedule work for periods of favorable weather.
2. Sod placement on days that, in the judgment of the Landscape Architect, are too hot, sunny, dry, or windy for optimal installation may be prohibited.

B. Plant freshly shredded sod sprigs in furrows [1 to 1-1/2 inches (25 to 38 mm)] deep. Place individual sprigs with roots and portions of stem in moistened soil, [6 inches (150 mm)] apart in rows [10 inches (250 mm)] apart, and fill furrows without covering growing tips. Lightly roll and firm soil around sprigs after planting.

C. Broadcast sprigs uniformly over prepared surface at a rate of [10 cu. ft./1000 sq. ft. (0.28 cu. m/92.9 sq. m)] and mechanically force sprigs into lightly moistened soil.

1. Spread a 1/4-inch- (6-mm-) thick layer of topsoil on sprigs.
2. Lightly roll and firm soil around sprigs after planting.
3. Water sprigs immediately after planting and keep moist by frequent watering until well rooted.

3.04 SODDING

A. Weather Conditions

1. Schedule work for periods of favorable weather.
2. Sod placement on days that, in the judgment of the Landscape Architect, are too hot, sunny, dry, or windy for optimal installation may be prohibited.

B. Placement Pattern

1. Only rolled sod shall be used. Runs shall be maximized to minimize small pieces. Lay sod to avoid small and skinny pieces.
2. Plastic netting shall be removed and properly disposed of upon installation as shown in the following photo:



3. The first row shall be laid in a straight line with subsequent rows parallel to the first row and tightly abutting each other.
4. Lateral joints shall be staggered. Care shall be exercised to insure that the sod is neither stretched nor overlapped. Joints must be butted tightly to minimize gaps from shrinkage and prevent voids that could permit air to dry out roots.
5. Immediately after placing, sod shall be pressed firmly into contact with sod bed by rolling to eliminate air pockets.
6. Immediately after sodding operations have been completed, entire surface shall be compacted with a roller or other approved equipment. The completed area after sodding shall be uniformly even, firm, and true to finished grade lines.
7. Sand joints and topdress turf with topdressing sand as necessary to provide a smooth uniform finished surface.

C. Watering

1. Provide an adequate supply of water at the site prior to and during transplanting of the sod.

3.04 MAINTENANCE

- A. Immediately after sodding or sprigging the area shall be protected against traffic or other use by erecting barricades as needed, and by placing approved warning signs at appropriate intervals.
- B. Mow during establishment only for the purpose of weed control and to promote quicker spreading. Mow to a 1" height.
- C. Fill any depressions or settlement that occurs within 90 days following installation. Resod bare spots that occur during the maintenance period as directed by the Landscape Architect.
- D. Keep turf clean and protected from damage during the maintenance period. Debris that accumulates shall be removed from the site. Promptly repair damaged turf except as provided in Paragraph 1.8, guarantee.
- E. Irrigate as required to supplement natural rainfall so that all lawn areas receive sufficient water for normal plant establishment and growth.
- F. A second fertilizer application shall be made 60 days after installation. The specified fertilizer shall be a ratio of 15-5-10 applied at 800 pounds per acre.

3.05 CLEANING, REMOVAL, AND REPAIR

- A. Paved areas over which hauling operations have been conducted shall be kept clean. Promptly remove materials spilled on pavement.
- B. Upon completion of turf installation, remove from the site and legally dispose of the following:
 1. Surplus subgrade material.
 2. Stone and foreign matter.
 3. Excess topsoil not required for planting.
- C. Repair existing turf damaged by operations under the contract. Repair shall include finish grading and sodding as required to match existing grade and lawn, and maintenance of repaired areas.

END OF SECTION

ELECTRICAL SPECIFICATIONS

DEER PARK SPORTS FIELDS

**PROJECT A:
SOCCER FIELD DEVELOPMENT (PHASE 1)**

**PROJECT B:
GIRLS SOFTBALL RENOVATIONS**



260050	BASIC ELECTRICAL MATERIALS AND METHODS
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL SYSTEMS AND CABLING
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
262200	LOW-VOLTAGE TRANSFORMERS
262416	PANELBOARDS
262726	WIRING DEVICES
262813	FUSES
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
264313	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
265613	LIGHTING POLES AND STANDARDS
265619	LED EXTERIOR LIGHTING

SECTION 260050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. All conditions imposed by these documents shall be applicable to all portions of the work under this Division. Certain specific paragraphs of said references may be referred to hereinafter in this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.
- B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Division shall not be used as a basis for a request for additional compensation.
- C. The specific features and details for other portions of the work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

1.2 SUMMARY

- A. The requirements contained in this Section apply to all work performed under Division 26 of these Specifications.
- B. The work covered by this Division of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.
- C. Refer to other Divisions of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

- A. Where the word "Contractor" is used under any Section of this Division of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section.

1.4 SUBMITTALS

- A. Process shop drawings and submittal data to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.
- B. Shop drawings shall be drawn on a scale not less than 1/4 inch equals 1 foot showing actual dimensions. Shop drawings shall include, but not be limited to:
 - 1. Switchboard.

2. Distribution panelboards.
 3. Lighting/appliance panelboards.
 4. Transformers.
 5. Disconnect switches.
 6. Circuit breakers and fuses.
 7. Materials: Conduit, conductors, connectors, supports, etc.
 8. Lighting fixtures, lamps and control systems/devices.
 9. Wiring devices.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Submittals and Shop Drawings that require modifications to other systems and trades shall be the sole responsibility of the submitting contractor to coordinate and pay for the modifications required by other systems and trades.

1.5 QUALITY ASSURANCE

- A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.
- B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.6 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. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

1.7 RESPONSIBILITY OF THE CONTRACTOR

- A. The Contractor shall be responsible for all work of every description in connection with this Division of the Specifications. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.
- B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.8 TERMINOLOGY

- A. Whenever the words "furnish," "provide," "furnish and install," "provide and install," and similar phrases occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary.
- B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Division of the Specifications be similarly furnished, installed and connected under this Division, whether or not a phrase as described in the preceding paragraph has been actually included.

1.9 ORDINANCES, PERMITS AND CODES

- A. It shall be the Contractor's duty to perform the work and provide the materials covered by these Specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.
- B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.
- C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.
- D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.
- E. The work shall be in accordance with, but shall not be limited to, the requirements of:

1. National Fire Protection Association.
2. National Electrical Code.
3. National Safety Code.
4. State of Texas Safety Codes.
5. State of Texas Building Codes.
6. City Building Codes and amendments.

- F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

1.10 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

- A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.
- B. Materials, equipment and devices furnished under this Division of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.
- C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.
- D. Space allocations for materials, equipment and devices have been made on the basis of present and know future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.11 REFERENCE STANDARDS

- A. Materials, equipment, devices, and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.
- B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, law and ordinances, industry standards or other governing regulations, the work shall be corrected of noncompliance deficiencies with the Contractor bearing all costs.
- C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply.
 1. AABM - American Association of Battery Manufacturers.
 2. AIA - American Institute of Architects.
 3. ANSI - American National Standards Institute.
 4. ASTM - American Society for Testing and Materials.

5. CBM - Certified Ballast Manufacturers Association.
6. ETL - Electrical Testing Laboratories.
7. FM - Factory Mutual.
8. ICEA - Insulated Cable Engineers Associated.
9. IEEE - Institute of Electrical and Electronic Engineers.
10. IES - Illuminating Engineering Society.
11. IRI - Industrial Risk Insurance.
12. NBS - National Bureau of Standards.
13. NEC - National Electrical Code.
14. NECA - National Electrical Contractors Association.
15. NEMA - National Electrical Manufacturers Association.
16. NESC - National Electrical Safety Code.
17. NETA - National Electrical Testing Association.
18. NFPA - National Fire Protection Association.
19. UL - Underwriters Laboratories.

- D. Where the Contract Documents exceed the above requirements, the Contract Documents shall govern. In no case shall work be installed contrary to or below the minimum legal standards.

1.12 DRAWINGS AND SPECIFICATIONS

- A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:
1. The Drawings establish quantities, locations, dimensions and details of materials, equipment and devices. The schedules on the Drawings indicate the capacities, characteristics and components.
 2. The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.
- B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:
1. If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive combination of quality and quantity of work indicated. In the event of this type of disagreement, the resolution shall be determined by the Architect/Engineer.
 2. The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Architect/Engineer prior to any work being performed.
 3. In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.
 4. Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large-scale details govern small-scale drawings.
 5. Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.
 6. Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.
- C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.

- D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Architect/Engineer for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.
- E. Review the construction details of the building(s) as illustrated on the Drawings of the various portions of the work and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.
- F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. Determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Architect/Engineer, without additional cost to the Owner.
- G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory operating installations. Prepare installation drawings for all critical areas illustrating the installation of the work in this Division as related to the work of all other Divisions and correct all interferences with the other portions of the work or with the building structures before the work proceeds.
- H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Division.

1.13 SUBSTITUTIONS

- A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.
- B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted, unless otherwise noted.
- C. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or Specifications, provide as part of the submittal 1/4 equals 1 foot scaled drawing showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
- D. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Architect/Engineer, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork, or wiring resulting from the equipment or device selection without any

additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.

- E. The Architect/Engineer reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
- F. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.14 INSTALLATION DRAWINGS

- A. Prepare installation drawings for coordinating the work of this Division with the work of other Divisions, to illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.
- B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Architect/Engineer for his information, review and record.

1.15 WORKMANSHIP AND INSTALLATION

- A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report it to the Owner's Representative and shall secure his approval before the work is started.
- B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.
- C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

1.16 WARRANTY

- A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Architect/Engineer for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the registration of these warranties so that the Owner can make all proper claims should future need develop.
- B. The Contractor shall furnish to the Architect/Engineer for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.17 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.18 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide the services of competent engineers and/or technicians acceptable to the Architect/Engineer to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.19 SCHEDULE AND SEQUENCE OF WORK

- A. The Contractor shall meet and cooperate with the Owner and Architect/Engineer to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.20 INSPECTIONS AND CERTIFICATIONS

- A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.
- B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities. Deliver the certificates to the Architect/Engineer for transmission to the Owner.

1.21 EQUIPMENT INSTALLATION

- A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.
- B. Equipment specified to be factory assembled and tested prior to shipment shall not be disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.

- C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.
- D. Large equipment assemblies and components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is complete.

1.22 EQUIPMENT FOUNDATIONS

- A. Provide foundations for electrical equipment. This shall consist of concrete housekeeping pads constructed in accordance with the details on the Drawings, these Specifications, manufacturer's recommendations and Division 3.
- B. All pads shall be 4" high and extend a maximum 2" beyond that actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Furnish all anchor bolts and other accessories required for casting the concrete pad. After the equipment is set on the pad, the equipment shall be fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.

1.23 SLEEVES

- A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.
- B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. The sleeves shall be sized to allow free passage of the conduit to be inserted.
- C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked with jute twine and filled with an asphalt-base compound to insure a waterproof penetration.

1.24 ESCUTCHEONS

- A. In each finished space, provide a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.
- B. Size escutcheons and collars to fit snugly around conduit and rods.
- C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

PART 2 - PRODUCTS

2.1 SITE ELECTRICAL

- A. The site electrical work shall include, but not be limited to, the furnishing and installation of necessary materials and making arrangements for the connection of electrical and telephone utilities and for underground conduit.
- B. All site electrical work shall be in accordance with latest National Electrical Code (NEC), Article 300, and service installation standards of the serving utility company(s).
- C. The location of the electrical service entrance shall be coordinated with the electric utility company and with all other trades. Provide materials and equipment required to connect the electrical service.
- D. Provide materials in accordance with other sections of these Specifications.
- E. The location of the telephone service entrance shall be coordinated with the telephone utility company and with all other trades. Provide materials and equipment required to connect the telephone service.
- F. The location of all underground electrical work such as service for parking lot lighting, site lighting, site security, etc. shall be coordinated with all other trades.
- G. Underground installation of more than one conduit shall be in a "ductbank" arrangement. All conduits shall be laid so joints are staggered.
- H. Pour a red colored concrete envelope minimum 3" thick over electrical and telephone service conduit.
- I. The electrical service entrance shall have a full concrete enclosed ductbank, in addition to the red colored concrete, with reinforcing rods installed.
- J. Perform excavation, shoring, backfilling and concrete work in connection with electrical work in accordance with other Divisions of the Specifications.
- K. All underground conduit shall be sloped away from the building to negate water entering the building through the conduit system.
- L. Provide underground warning tape 6" to 12" below finished surface along entire length of underground conduit or ductbank. Provide a separate length of tape every 24" in width of ductbank. Interface installation of underground warning tape with backfilling.
- M. The locations, elevations and voltage of electrical lines and the location of the telephone lines included within the area of this work are indicated on the Drawings or in the Specifications in accordance with information received by the Owner.
- N. The Contractor shall examine the site and shall verify, to his own satisfaction, the location and elevation of all utilities and shall adequately inform himself as to their relation to the work.
- O. Work associated with existing utility lines to be abandoned or removed, located within the scope of this project, will be coordinated by the Contractor (with the Owner's oversight) with the respective utility.
- P. Existing utility lines not indicated but encountered during construction shall be protected, relocated or capped as directed by the Owner's Representative. All precautions shall be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized prior to execution except in an emergency situation.

- Q. Before beginning excavations of any nature whatsoever, the Contractor shall make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. The Contractor shall then proceed with caution in his excavation work so that no utility shall be damaged with a resultant loss of service.
- R. Should damage result to any utility through the Contractor's negligence or failure to comply with the above directive, he shall be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities.
- S. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner.

PART 3 - EXECUTION

3.1 EXCAVATION, TRENCHING AND BACKFILLING

- A. All excavating, trenching and backfilling shall generally be performed in accordance with the procedures and using the materials as described in Division 2. Provide all excavation required in connection with the installation of the work under this Division. After the work has been installed, tested and approved, backfill all excavations with suitable material.
- B. Bottoms of trenches shall be cut to grade. Should rock be encountered, same shall be excavated to a depth of six (6) inches below bottom of conduit and space shall be filled and tamped as specified hereinafter. Should it be required to lay conduit on fill, fill shall first be compacted.
- C. All conduit shall be installed promptly after excavation has been done so as to keep excavations open as short a time as possible.
- D. Trenches shall be excavated to the required depths. Depth of cover shall be as required by the NEC or as indicated on Drawings. Keep banks of trenches as nearly vertical as possible, and provide adequate shoring where required.
- E. When excavation is below the shale or subgrade level, backfill with granular fill or approved backfill material from the site to a depth of 12 inches above top of conduit, but in no case less than 1'-0" below the subgrade surface. The remainder of backfill to the shale or subgrade surface shall be an impervious material and shall be compacted at not less than 95 percent of the maximum dry density as defined by ASTM D-698. At all times, the top of the subgrade shall be kept in such condition that it will drain readily and effectively. Backfill above the subsurface shall be granular fill or approved select backfill from site.
- F. Beyond building walls or above the shale or subgrade level, backfill with sand or granular fill to a depth of 12 inches above top of conduit and remainder of trench filled with approved select backfill material from the site.
- G. Bottoms of trenches shall be tamped hard and graded to secure the maximum fall. Where rock is excavated below the bottom of the conduit, and before laying the conduit, fill the space between the bottom of the conduit and the rock surface with sand, thoroughly tamped.
- H. Trenches dug in fill shall have the conduit supported down to load-bearing soil. After conduits have been inspected and approved by the Owner's Representative, trenches shall be filled with approved backfill material which shall be firmly compacted, flooded if necessary and thoroughly tamped. Do not backfill with any fill containing rocks, frozen earth or debris.

- I. Include the cutting of all sidewalks, streets and other pavements and repairing the openings in them to return the surface to approximately its original condition.

3.2 CUTTING AND PATCHING

- A. Cut all openings required to install the work or to repair any defective work. This cutting shall be performed under the Architect's/Engineer's direction and due diligence exercised to avoid cutting openings larger than required or in the wrong locations.
- B. No cutting or drilling of any sort will be permitted in the webs of prestressed, precast concrete structural elements. Use core drills or power driven saws to cut openings in the flanges of other such structural elements; the use of reciprocating drills will not be permitted. The cutting of structural members without first having received written permission from the Architect/Engineer is prohibited.
- C. Where openings are cut in fire-rated walls or floors, seal the annular space between the work installed and the fire-rated construction. Sealant, as applied, shall be fire rated to maintain the fire rating of the construction penetrated. Sealant shall be re-enterable (before fire) to alter penetrations. Apply in strict accordance with manufacturer's instructions.

3.3 SEALING OF PENETRATIONS

- A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:
 - 1. Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).
 - 2. Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.
 - 3. Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, as selected by applicator.
- B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.
- C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.

3.4 PROTECTION OF APPARATUS

- A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Architect/Engineer will be sufficient cause for the rejection of the pieces of apparatus in question.
- B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Division of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.

- C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

3.5 INSTALLATION AND CONNECTION OF OTHER DIVISION'S EQUIPMENT

- A. Verify the electrical requirements of all equipment furnished under other Divisions, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as require for complete operation of all equipment.

3.6 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

- A. The location of power, data and telephone outlets, wall switches and other related devices may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 15 feet of their present location provided the Contractor is notified prior to installation.

- 3.7 Provide temporary utility services for construction and testing of systems in accordance with the requirements of Division 1 and Division 2.

3.8 COOPERATION AND CLEAN-UP

- A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe condition. Upon the completion of the job, the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.
- B. After the installation is complete, and before the equipment is energized, clean the interior and exterior of all equipment thoroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material removed. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with a lemon-oil rag after other cleaning is complete.
- C. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

3.9 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

- A. The Contractor shall obtain at his own expense a complete set of prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. All piping and conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical elevation, unless a surface mounted device in each space indicates the exact location. Obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. The above data, with the exception of the record drawings, shall be delivered prior to final acceptance.
- B. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring looseleaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder

shall exceed 3-1/2 inches thick. This data shall be turned over to the Architect/Engineer for review and subsequent delivery to the Owner prior to final acceptance.

1. Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
2. Approved lighting fixture brochures, wiring diagrams and control diagrams.
3. Copies of approved submittals and shop drawings.
4. Operating instructions for major apparatus and recommended maintenance procedures.
5. Copies of all other data and/or drawings required during construction.
6. Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
7. Tag charts and diagrams hereinbefore specified.

3.10 FINAL OBSERVATION

- A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance by the Owner.
- B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Architect/Engineer to make a final observation.

END OF SECTION 260050

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Metal-clad cable, Type MC, rated 600 V or less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Alpha Wire Company.
 2. American Bare Conductor.
 3. Belden Inc.
 4. Cerro Wire LLC.
 5. Encore Wire Corporation.
 6. General Cable Technologies Corporation.
 7. Service Wire Co.
 8. Southwire Company.
 9. WESCO.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 or ASTM B 496 for stranded conductors.
- E. Conductor Insulation:
1. Type THHN and THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Alpha Wire Company.
 2. American Bare Conductor.
 3. Belden Inc.
 4. Cerro Wire LLC.
 5. Encore Wire Corporation.
 6. General Cable Technologies Corporation.
 7. Service Wire Co.
 8. Southwire Company.
 9. WESCO.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. RoHS compliant.
 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
- H. Armor: Steel or Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. 3M Electrical Products.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. ILSCO.
 - 6. NSi Industries LLC.
 - 7. O-Z/Gedney; a brand of Emerson Industrial Automation.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1) Test wells.
 - 2) Ground rods.
 - 3) Grounding arrangements and connections for separately derived systems.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. Galvan Industries, Inc.; Electrical Products Division, LLC.
 - 4. Harger Lightning & Grounding.
 - 5. ILSCO.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 7. Siemens Power Transmission & Distribution, Inc.
 - 8. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- J. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
- K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- L. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- G. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are polymer concrete and shall be at least 12 inches deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: **10** ohms.
 - 2. Power Distribution Units or Panelboards Serving Electronic Equipment: **3** ohm(s).
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Hangers.
 - b. Steel slotted support systems.
 - c. Trapeze hangers.
 - d. Clamps.
 - e. Sockets.
 - f. Saddles.
 - g. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Delegated-Design Submittal: For hangers and supports for electrical systems.
 - 1. Include design calculations and details of trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which hangers and supports will be attached.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.

- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Projectors.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Qualify procedures and personnel according to the following:

- 1. AWS D1.1/D1.1M.
- 2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. B-line, an Eaton business.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. G-Strut.
 - f. Thomas & Betts Corporation; A Member of the ABB Group.
 - g. Unistrut; Part of Atkore International.
- 2. Material: Galvanized steel.
- 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- 4. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line, an Eaton business.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: Stainless-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Comply with requirements in Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a part of Atkore International
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company
 - 5. FSR Inc.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation
 - 7. Picoma Industries, Inc.
 - 8. Republic Conduit
 - 9. Robroy Industrial
 - 10. Southwire Company
 - 11. Thomas & Betts Corporation, A Member of the ABB Group
 - 12. Western Tube and Conduit Corporation
 - 13. Wheatland Tube Company
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation
 - 4. CANTEX INC.
 - 5. CertainTeed Corporation
 - 6. Condux International Inc.
 - 7. Electri-Flex Company
 - 8. Kraloy
 - 9. Lamson & Sessions
 - 10. Niedax, Inc.
 - 11. RACO; Hubbell
 - 12. Thomas & Betts Corporation, A Member of the ABB Group
 - 13. Western Tube and Conduit Corporation
 - 14. Wheatland Tube Company
 - 15.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. RTRC: Comply with UL 1684A and NEMA TC 14.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc; a division of Cooper Industries.
 - 2. Hoffman; a brand of Pentair Equipment Protection
 - 3. MonoSystems, Inc.
 - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 and Type 3R unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Adalet
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds
 - 3. EGS/Appleton Electric
 - 4. Erickson Electrical Equipment Company
 - 5. FSR, Inc.
 - 6. Hoffman
 - 7. Hubbell Incorporated
 - 8. Kraloy
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney
 - 12. RACO; Hubbell
 - 13. Robroy Industries
 - 14. Spring City Electrical Manufacturing Company
 - 15. Stahlin Non-Metallic Enclosures
 - 16. Thomas & Betts Corporation
 - 17. Wiremold/Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
 - 1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company
 - b. Carson Industries, LLC
 - c. NewBasis
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power Systems, Inc.
 - f. Synertech Moulded Products.
 - 2.
 3. Standard: Comply with SCTE 77.
 4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 7. Cover Legend: Molded lettering, "ELECTRIC."
 8. Handholes 12 Inches Wide by 23 Inches Long (300 mm Wide by 575 mm Long) by 11 inches (280 mm) deep and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
 2. Concealed Conduit, Aboveground: GRC or IMC.
 3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Vehicle repair areas.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC or IMC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of air conditioned spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LPMC in damp or wet locations subject to severe physical damage.
 - 2. Use LPMC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Section 312000 "Earth Moving."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
 - 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 - 5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel 9-inches deep, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
- b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following, or equal:
 - a. HOLDRITE.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe 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.

- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways and conductors.
 - 2. Labels.
 - 3. Tapes and stencils.
 - 4. Tags.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145 for safety signs and labels.
- D. Comply with NFPA 70E requirements for arc-flash warning labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

- 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.

- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

- 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White or gray.
 - 6. Color for Equipment Grounds: Green.

- C. Warning Label Colors:

- 1. Identify system voltage with black letters on an orange background.

- D. Warning labels and signs shall include, but are not limited to, the following legends:

- 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

- A. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A'n D Cable Products.
 - b. Brady Corporation
 - c. Brother International Corporation
 - d. Emedco
 - e. Grafoplast Wire Markers
 - f. Hellermann Tyton
 - g. Ideal Industries, Inc.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Panduit Corp.
 - k. Seton Identification Products.
2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

- A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
- B. Underground-Line Warning Tape:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation
 - b. Ideal Industries, Inc.
 - c. LEM Products, Inc.
 - d. Marking Services, Inc.
 - e. Reef Industries, Inc.
 - f. Seton Identification Products.
 2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

- b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- 3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 TAGS

- A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Grafoplast Wire Markers.
 - e. LEM Products Inc.
 - f. Marking Services, Inc.
 - g. Panduit Corp.
 - h. Seton Identification Products.

2.6 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
 - 2. Engraved legend.
 - 3. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch.

- b. For signs larger than 20 sq. in., 1/8 inch thick.
- c. Engraved legend with black letters on white face.
- d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Ideal Industries, Inc.
 - b. Marking Services, Inc.
 - c. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Source Panel and Circuit number.
- K. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- L. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- M. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- N. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound color-coding bands to identify the phase.

- D. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- H. Auxiliary Electrical Systems Conductor Identification: Marker tape or self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Arc Flash Warning Labeling: Self-adhesive labels.
- K. Equipment Identification Labels:
 - 1. Outdoor Equipment: Stenciled legend 4 inches high.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a stenciled legend.
 - b. Enclosures and electrical cabinets.
 - c. Switchboards.
 - d. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Pushbutton stations.
 - i. Contactors.
 - j. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

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SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 500 kVA.

1.3 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

Shop Drawings:

3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
5. Include diagrams for power, signal and control wiring.

1.4 INFORMATIONAL SUBMITTALS

Qualification Data: For testing agency.

Source quality-control reports.

Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

Operation and Maintenance Data: For transformers to include in emergency operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Acme Electric Corporation.
2. Eaton.
3. General Electric Company.
4. Jefferson Electric, Inc.
5. Powersmiths International Corp.
6. Siemens Power Transmission & Distribution, Inc.
7. Sola/Hevi-Duty; a brand of Emerson Electric Co.
8. Square D; by Schneider Electric.

Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Transformers Rated 15 kVA and Larger: Comply with U.S. Department of Energy CFR Title 10 Chapter 2 Part 431 (2016) energy-efficiency levels as verified by testing according to UL and meeting IECC 2015, C405.7

Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

Comply with NFPA 70, listed and labeled as complying with UL 1561, and meeting IECC 2015, C405.7.

Cores: One leg per phase.

Enclosure: Ventilated.

1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

Transformer Enclosure Finish: Comply with NEMA 250.

2. Finish Color: Gray.

Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

3. 9 kVA and Less: 40.
4. 30 to 50 kVA: 45.
5. 51 to 150 kVA: 50.
6. 151 to 300 kVA: 55.
7. 301 to 500 kVA: 60.

2.4 IDENTIFICATION DEVICES

Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 05 53 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
2. Ratio tests at the rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at the rated voltage connections.
4. No load losses, and excitation current and rated voltage at the rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

Examine walls, roofs, floors concrete bases for suitable mounting conditions where transformers will be installed.

Verify that ground connections are in place and requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

Environment: Enclosures shall be rated for the environment in which they are located.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install transformers level and plumb on a concrete base with vibration-dampening supports.

Construct concrete bases according to Section 03 30 00 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

Secure transformer to concrete base according to manufacturer's written instructions.

Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

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-486B.

Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

Perform tests and inspections with the assistance of a factory-authorized service representative.

Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.

Remove and replace units that do not pass tests or inspections and retest as specified above.

Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency operation, and maintenance manuals. In addition to items specified in other sections, include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:
 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

- a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
- b. Outdoor Locations: NEMA 250, Type 3R.
- c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4, stainless steel.

2. Height: 84 inches maximum.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

4. Finishes:

- a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
- b. Back Boxes: Galvanized steel.

F. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
 2. ESL Power Systems, Inc.
 3. General Electric Company; GE Energy Management - Electrical Distribution.
 4. Siemens Energy.
 5. Square D: by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or Lugs only. As scheduled on drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. Siemens Energy.
 4. Square D: by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only. As scheduled on drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
 2. General Electric Company; GE Energy Management - Electrical Distribution.
 3. Siemens Energy.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
- b. Instantaneous magnetic trip element for short circuits.
- c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Electronic Trip Circuit Breakers:

- a. RMS sensing.
- b. Field-replaceable rating plug or electronic trip.
- c. Digital display of settings, trip targets, and indicated metering displays.
- d. Multi-button keypad to access programmable functions and monitored data.
- e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
- f. Integral test jack for connection to portable test set or laptop computer.
- g. Field-Adjustable Settings:

- 1) Long and short time adjustments.
- 2) Ground-fault pickup level, time delay, and $I^2 T$ response.

3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

5. Subfeed Circuit Breakers: Vertically mounted.

6. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Breaker handle indicates tripped status.
- c. UL listed for reverse connection without restrictive line or load ratings.
- d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
- e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
- f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
- g. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
- i. Auxiliary Contacts: Two, SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- j. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
- k. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- l. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
- m. Multipole units enclosed in a single housing with a single handle.
- n. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- o. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.

- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting:
 - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.
- I. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- K. Install filler plates in unused spaces.
- L. Stub four 1-inch empty conduits into raised floor space or below slab not on grade, extending 5'-0" beyond slab.
- M. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience receptacles.
 - 2. GFCI receptacles.
 - 3. Toggle switches.
 - 4. Wall plates.

1.2 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Copper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles, 125 V, 20 A, 10 KA short circuit rating: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; Commercial Grade Receptacles 20A-1125V NEMA 5-20R – BR20 and Weather Resistant Commercial Grade Receptacles 20A-125V NEMA 5-20R – WRBR20.
 - b. Hubbell Incorporated; Wiring Device-Kellems; HBL 5361(single), 5362 (duplex).
 - c. Leviton Manufacturing Co., Inc.; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour/Legrand (Pass & Seymour); 5361 (single), 5361 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection (self testings)
 - 4. Tamper-resistant, weather resistant.
- B. Duplex GFCI Convenience Receptacles:
 - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; TWRBR20GY
 - b. Hubbell Incorporated; Wiring Device-Kellems; GFR 5362SGGY
 - c. Leviton Manufacturing Co., Inc.; GFWT2-HGG
 - d. Pass & Seymour/Legrand (Pass & Seymour); 2095TRWR-GRY.
- C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems; GFTR20
 - b. Pass & Seymour/Legrand (Pass & Seymour); 2095TR

2.4 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

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

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1221 AC Quiet Toggle Switches.
- 2) Hubbell Incorporated; Wiring Device-Kellems; HBL1221
- 3) Leviton Manufacturing Co., Inc.; 1221-2
- 4) Pass & Seymour/Legrand (Pass & Seymour); CSB20AC1.

2. Two Pole:

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

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1222
- 2) Hubbell Incorporated; Wiring Device-Kellems; HBL1222
- 3) Leviton Manufacturing Co., Inc.; 1222-2
- 4) Pass & Seymour/Legrand (Pass & Seymour); CSB20AC2.

3. Three Way:

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

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1223
- 2) Hubbell Incorporated; Wiring Device-Kellems; HBL1223
- 3) Leviton Manufacturing Co., Inc.; 1223-2
- 4) Pass & Seymour/Legrand (Pass & Seymour); CSB20AC3.

C. Pilot-Light Switches, 120/277 V, 20 A:

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

- 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1221PL for 120 and 277 V.
- 2) Hubbell Incorporated; Wiring Device-Kellems; HBL1201 for 120 and 277 V.
- 3) Leviton Manufacturing Co., Inc.; 1221-LH1
- 4) Pass & Seymour/Legrand (Pass & Seymour); PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V..

2. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

2.5 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

- B. Wet-Location, Damp Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover, listed for "while in use"

2.6 FINISHES

- A. Device Color:
 - 1. Gray unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

H. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

A. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Perform the following tests and inspections:

1. Tests for Convenience Receptacles:

- a. Line Voltage: Acceptable range is 105 to 132 V.
- b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
- c. Ground Impedance: Values of up to 2 ohms are acceptable.
- d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
- e. Using the test plug, verify that the device and its outlet box are securely mounted.
- f. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

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SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
 - 5. Coordination charts and tables and related data.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type used.

1.6 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Bussmann, an Eaton business.
 2. Edison; a brand of Bussmann by Eaton.
 3. Littelfuse, Inc.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, time delay.
 3. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
 5. Type T: 250-V, zero- to 1200-A rating, 200 kAIC, very fast acting.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 10 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Feeders: Class RK1, time delay or Class J, time delay.
 - 2. Motor Branch Circuits: Class RK1, time delay.
 - 3. Other Branch Circuits: Class RK1, time delay.
 - 4. Control Transformer Circuits: Class CC, time delay, control transformer duty.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Construction Manager.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.
- B. Shop Drawings: For enclosed switches.
 - 1. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in other sections, include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. ABB Inc.
 - 2. Eaton.
 - 3. General Electric Company.
 - 4. Siemens Industry, Inc.
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240 or 600-V ac. As scheduled.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 5. Lugs: Compression type, suitable for number, size, and conductor material.
 - 6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Siemens Industry, Inc.

- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 4. Lugs: Compression type, suitable for number, size, and conductor material.

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton
 - 2. General Electric Company
 - 3. Siemens Industry, Inc.
 - 4. Square D; by Schneider Electric
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 167 deg F rated wire or 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.
- G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2.5 ENCLOSURES

- A. Enclosed Switches: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1) or directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R or Type 4X.

3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.

- E. Comply with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

- b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

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SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Comply with UL 1449.

- D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies Inc. (APT).
 - 2. Eaton.
 - 3. General Electric Company.
 - 4. Intermatic, Inc.
 - 5. LEA International.
 - 6. Leviton Manufacturing Co., Inc.
 - 7. Siemens.
- B. SPDs: Comply with UL 1449, **Type 2**.
 - 1. SPDs with the following features and accessories:
 - a. Integral disconnect switch.
 - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - c. Indicator light display for protection status.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1200 V for 480Y/277 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V.
 - 3. Line to Line: 2000 V for 480Y/277 V.
- E. SCCR: Equal or exceed 100 kA.
- F. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies Inc. (APT).
 - 2. Eaton.
 - 3. General Electric Company.
 - 4. Intermatic, Inc.
 - 5. LEA International.
 - 6. Leviton Manufacturing Co., Inc.
 - 7. Siemens.
- B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V.
 2. Line to Ground: 1200 V for 480Y/277 V.
 3. Neutral to Ground: 1200 V for 480Y/277 V.
 4. Line to Line: 2000 V for 480Y/277 V.
- E. SCCR: Equal or exceed 100 kA.
- F. Inominal Rating: 20 kA.

2.4 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.
- B. Outdoor Enclosures: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 2. Inspect anchorage, alignment, grounding, and clearances.

- 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Poles and accessories for support of luminaires.

1.2 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete lighting fixture.
- C. Pole: Luminaire-supporting structure.
- D. Standard: See "Pole."

1.3 ACTION SUBMITTALS

- A. Product Data: For each pole and accessory.
- B. Shop Drawings:
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Detail fabrication and assembly of poles and pole accessories.
 - 3. Anchor bolt templates keyed to specific poles and certified by manufacturer.
 - 4. Method and procedure of pole installation. Include manufacturer's written installations.

1.4 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- B. Material test reports.
- C. Field quality-control reports.
- D. Sample warranty.
- E. Soil test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data for pole and pole-mounted accessories.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- B. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.
- C. Ice Load: Load of 3 lbf/sq. ft., applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
 - 1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.
 - a. Wind Importance Factor: 1.0.
- E. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Valmont Industries, Inc.
 - b. Hapco.
 - c. Hubbell Incorporated
 - d. KIM Lighting
 - e. Lithonia Lighting, Acuity Brands Lighting, Inc.
 - f. LSI Corporation of America
 - g. US Pole Lighting Company, Inc.

- B. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.
- C. Poles: Comply with ASTM A 500/A 500M, Grade B carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- D. Steel Mast Arms: Davit type, continuously welded to pole attachment plate. Material and finish same as plate.
- E. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- F. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.
- G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.
 - a. Color: As indicated by manufacturer's designations.

2.3 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.4 MOUNTING HARDWARE

- A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.

- B. Nuts: ASTM A 563, Grade A, Heavy-Hex
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Four nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.
- C. Washers: ASTM F 436, Type 1.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Two washers provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 POLE FOUNDATION

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Anchor Bolts: Install plumb using manufacturer-supplied steel template, uniformly spaced.

3.2 POLE INSTALLATION

- A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.
- B. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
- C. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.
- D. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.3 CORROSION PREVENTION

- A. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.4 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

END OF SECTION 265613

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SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.5 FIELD CONDITIONS

- A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and listed for wet location.
- D. Lamp base complying with ANSI C81.61.
- E. CRI of minimum 80. CCT of 4100 K.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Nominal Operating Voltage: 120 to 277 V, or as scheduled.
- I. In-line Fusing: Separate in-line fuse for each luminaire.
- J. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- K. Source Limitations: Obtain luminaires from single source from a single manufacturer.

2.2 LUMINAIRE TYPES

- A. Area and Site:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Architectural Area Lighting
 - b. Spaulding Lighting
 - c. Cooper Lighting
 - d. Deco Lighting
 - e. Hubbell Lighting
 - f. KIM Lighting
 - g. Lightolier; a Philips group brand
 - h. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - i. MUSCO

- j. US Pole
 - 2. Luminaire Shape: Rectangular.
 - 3. Mounting: As scheduled.
 - 4. Luminaire-Mounting Height: As scheduled.
 - 5. Distribution: As scheduled.
- B. Canopy:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper Lighting
 - b. Hubbell Lighting
 - c. Spaulding Lighting
 - d. KIM Lighting
 - e. Lightolier; a Philips group brand
 - f. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - g. US Architectural Lighting
 - h. Sun Valley Lighting
 - 2. Shape: Round.

2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Install lamps in each luminaire.
- C. Fasten luminaire to structural support.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- H. Coordinate layout and installation of luminaires with other construction.

- I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Luminaire will be considered defective if it does not pass tests and inspections.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 265619

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SECTION 000107 - SEALS PAGE

PART 1 - Seals Page

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Ryan Hansanuwat.
2. 22732.
3. Responsible for Divisions 01-12 Sections except where indicated as prepared by other design professionals of record.

END OF SECTION 000107



SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type and color of the following:
 - 1. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

- A. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches** down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F** and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 3. Size (Width): Manufactured to the following dimensions:
 - a. 100 mm nominal; 92 mm actual.
 - b. 150 mm nominal; 143 mm actual.
 - c. 200 mm nominal; 194 mm actual.
 - d. 250 mm nominal; 244 mm actual.
 - e. 300 mm nominal; 295 mm actual.
 - f. 400 mm nominal; 396 mm actual.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Wire Size for Veneer Ties: 0.148-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.

2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, **G60** zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 666, Type 304.
 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 8. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from **0.105-inch**-thick, steel sheet, galvanized after fabrication.
 - a. **0.064-inch**- thick, galvanized sheet may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch** of masonry face, made from **0.187-inch**- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 3. Corrugated Metal Ties: Metal strips not less than **7/8 inch** wide with corrugations having a wavelength of **0.3 to 0.5 inch** and an amplitude of **0.06 to 0.10 inch** made from **0.060-inch**-thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within **1 inch** of masonry face.
 - a. **0.064-inch**- thick, galvanized sheet may be used at interior walls unless otherwise indicated.
- C. Rigid Anchors: Fabricate from steel bars bent to configuration indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- 2.7 MISCELLANEOUS ANCHORS
- A. Anchor Bolts: Headed steel bolts complying with **ASTM A 307, Grade A** ; with **ASTM A 563** hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- 2.8 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi .
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus **1/2 inch** or minus **1/4 inch**.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus **1/2 inch**.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus **1/4 inch** in a story height or **1/2 inch** total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than **1/4 inch in 10 feet**, or **1/2 inch** maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet**, **1/4 inch in 20 feet**, or **1/2 inch** maximum.

3. For vertical lines and surfaces do not vary from plumb by more than $1/4$ inch in 10 feet , $3/8$ inch in 20 feet , or $1/2$ inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than $1/8$ inch in 10 feet , $1/4$ inch in 20 feet , or $1/2$ inch maximum.
5. For lines and surfaces do not vary from straight by more than $1/4$ inch in 10 feet , $3/8$ inch in 20 feet , or $1/2$ inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than $1/4$ inch in 10 feet , or $1/2$ inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus $1/8$ inch , with a maximum thickness limited to $1/2$ inch .
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than $1/8$ inch .
3. For head and collar joints, do not vary from thickness indicated by more than plus $3/8$ inch or minus $1/4$ inch .
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus $1/8$ inch .

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4 -inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 -inches . Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 -inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- H. Fill cores in hollow CMUs with grout **24 inches** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide **1/2-inch** clearance between end of anchor rod and end of tube. Space anchors **48 inches** o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch** on exterior side of walls, **1/2 inch** elsewhere. Lap reinforcement a minimum of **6 inches**.
 - 1. Space reinforcement not more than **16 inches** o.c.
 - 2. Space reinforcement not more than **8 inches** o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than **8 inches** above and below wall openings and extending **12 inches** beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches .

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.

- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 PARING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch . Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot . Form a wash at top of paring and a cove at bottom.
- C. Damp-cure paring for at least 24 hours and protect paring until cured.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 042300 - GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass block set in mortar.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: Glass-block units and joint materials involving color selection.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical exterior and interior panel, 48 by 48 inches in size.
 - 2. Build mockup of typical exterior wall area containing glass unit masonry assembly as shown on Drawings.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 40 deg F or higher.
 - 1. Maintain temperature in installation areas at 40 deg F or above for 48 hours after installing.
 - 2. Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or when joint substrates are wet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass Block: Obtain each type and pattern of glass block from single source from single manufacturer.
- B. Source Limitations for Accessory Materials: Obtain each cementitious material and accessory component through single source from single manufacturer and each aggregate from single source or producer.

2.2 GLASS BLOCK

- A. Hollow Glass Block: Hollow units made from transparent glass, with manufacturer's standard edge coating.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Seves Manufacturing
 - 3. Glass Color: Colorless.
 - 4. Pattern: Wavy, light-diffusive design on inner faces, and smooth outer faces.
 - 5. Edge-Coating Color: As indicated by manufacturer's designations.
 - a. Provide one color throughout for each pattern indicated.
 - b. Provide multiple colors as indicated for each size and pattern.
 - 6. Sizes: Manufacturer's standard sizes corresponding to nominal sizes indicated on Drawings.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
- E. Aggregate: ASTM C 144, with 100 percent passing No. 8 sieve.
- F. Water: Potable.

2.4 GLASS UNIT MASONRY ACCESSORIES

- A. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless-steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.
- B. Sealants: Manufacturer's standard elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants."
- C. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Section 079200 "Joint Sealants."

2.5 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
- B. Mortar for Glass Unit Masonry Assemblies: Provide mortar, mixed according to glass-block manufacturer's listing with testing and inspecting agency, for fire-resistance rating indicated.
- C. Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C 270, Proportion Specification for Type S mortar.
 - 1. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard mortar when it has reached initial set.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING GLASS BLOCK WITH MORTAR

- A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.
- B. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain **3/8-inch** exposed joint widths unless otherwise indicated.
- C. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.
- D. Use plastic spacers or temporary wedges in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.
 - 1. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.
- E. Keep expansion joints free of mortar.
- F. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
 - 1. If temporary wedges are used, remove them before raking out and pointing joints.
- G. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.
- H. Install sealant at jambs, heads, mullions, and other locations indicated. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Section 079200 "Joint Sealants."
- I. Construction Tolerances: Set glass block to comply with the following tolerances:
 - 1. Variation from Plumb: For vertical lines and surfaces, do not exceed **1/4 inch in 10 feet** , **3/8 inch in 20 feet** , or **1/2 inch in 40 feet** or more.

2. Variation from Level: For bed joints and other conspicuous lines, do not exceed $\frac{1}{8}$ inch in 10 feet , $\frac{1}{4}$ inch in 20 feet or $\frac{1}{2}$ inch in 40 feet or more.
3. Variation of Location in Plan: For location of elements in plan, do not vary from that indicated by more than plus or minus $\frac{1}{4}$ inch .
4. For faces of adjacent exposed units, do not vary from flush alignment by more than $\frac{1}{16}$ inch .

3.3 CLEANING

- A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.
- B. Remove excess sealants with commercial solvents according to sealant manufacturer's written instructions. Exercise care not to damage sealant in joints.
- C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 042300

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking[, cants,] and nailers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
 - 3. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, [mark grade stamp on end or back of each piece] [or] [omit grade stamp and provide certificates of grade compliance issued by grading agency].
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: [15 percent][19 percent][15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness][15 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness][19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness] unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 [for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. [Do not use inorganic boron (SBX) for sill plates.]
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, [mark end or back of each piece] [or] [omit marking and provide certificates of treatment compliance issued by inspection agency].

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
 2. Nailers.
 3. Cants.
- B. Concealed Boards: [15][19] percent maximum moisture content of [any of the following][the following] species and grades:
1. Mixed southern pine or southern pine, [No. 2][No. 3] grade; SPIB.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners [with hot-dip zinc coating complying with ASTM A 153/A 153M][of Type 304 stainless steel].
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.

- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches** o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal** thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft.** and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet** o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish

materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for [screeding or] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof sheathing.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 ROOF SHEATHING

- A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exterior sheathing.
 - 1. Nominal Thickness: Not less than 15/32 inch .

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
1. Wall and Roof Sheathing:
 - a. Nail to wood framing.
 - b. Space panels **1/8 inch** apart at edges and ends.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood roof trusses.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for roof sheathing and subflooring.
- C. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.

- B. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S.
 - 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061053 "Miscellaneous Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Source Limitations: Obtain metal connector plates from single manufacturer.
- B. General: Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
 - 1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.6 FABRICATION

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

2.7 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061053 "Miscellaneous Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- K. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

061753

SHOP-FABRICATED WOOD
TRUSSES

- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 061753

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes standing-seam metal roof panels.
- B. Related Sections:
 - 1. Section 074213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.
 - 2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
- b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. .
- B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels:- Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 - 1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch .
 - b. Exterior Finish: Two-coat fluoropolymer.

- c. Color: As selected by Architect from manufacturer's full range.
- 2. Clips: One-piece fixed to accommodate thermal movement.
 - a. Material: **0.028-inch**- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
- 3. Joint Type: As standard with manufacturer.
- 4. Panel Coverage: **24 inches** .
- 5. Panel Height: **2.0 inches** .

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils** thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at **240 deg F** ; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus **20 deg F** ; ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch**-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable

variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations

indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches** . Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.
 2. Apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of **24 inches** beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of **18 inches** . Overlap ends of sheets not less than **6 inches** .
 - c. Rake edges for a distance of **18 inches** .
 - d. Hips and ridges for a distance on each side of **12 inches** .
 - e. Roof-to-wall intersections for a distance from wall of **18 inches** .
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches** .
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet** with no joints allowed within **24 inches** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of

intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof-edge specialties.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 074113.16 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces.

2.2 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - 1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal thickness as required to meet performance requirements.
 - a. Surface: Embossed finish.
 - b. Finish: Insert finish.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and continuously welded.
 - 3. Splice Plates: Exposed, of same material, finish, and shape as fascia cover.
 - 4. Receiver: Manufacturer's standard material and thickness.
 - 5. Special Fabrications: Radiussed sections.
 - 6. Fascia Accessories: Fascia extenders with continuous hold-down cleats.

2.3 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F .
 - 2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F .

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches**. Roll laps with roller. Cover underlayment within 14 days.
1. Apply continuously under roof-edge specialties.
 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of **12 feet** with no joints within **18 inches** of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between **40 and 70 deg F**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F**.

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches ; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ceco Door
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. All Doors.
 1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch , with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Core: Vertical steel stiffener.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch , with minimum A40 coating.
 - b. Construction: Full profile welded.
 4. Exposed Finish: Prime.

2.4 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

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

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches , as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 2. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

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- b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
6. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
- 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
- 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

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- b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - d. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus $1/16$ inch , measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus $1/16$ inch , measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus $1/16$ inch , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus $1/16$ inch , measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: $1/8$ inch plus or minus $1/32$ inch .
 - b. Between Edges of Pairs of Doors: $1/8$ inch to $1/4$ inch plus or minus $1/32$ inch .
 - c. At Bottom of Door: $3/4$ inch plus or minus $1/32$ inch .
 - d. Between Door Face and Stop: $1/16$ inch to $1/8$ inch plus or minus $1/32$ inch .

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Counter doors.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for finish painting of factory-primed doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
 - 1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY-

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.
- C. Door Curtain Material: Aluminum.
- D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.
 - 1. Insulated-Slat Interior Facing: Metal.
 - 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated hot-dip galvanized steel and finished to match door.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Integral Frame, Hood, and Fascia: Galvanized steel.
 - 1. Mounting: Face of wall.
- H. Sill Configuration: No sill.
- I. Locking Devices: Equip door with slide bolt for padlock.
- J. Manual Door Operator: Chain-hoist operator.
 - 1. Provide operator with through-wall shaft operation.
- K. Curtain Accessories: Equip door with weatherseals and push/pull handles.
- L. Door Finish:

1. Aluminum Finish: Clear anodized.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 1. Aluminum Door Curtain Slats: **ASTM B 209** sheet or **ASTM B 221** extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of **0.050 inch** ; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
 1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.5 HOODS

- A. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
 1. Galvanized Steel: Hot-dip galvanized steel sheet with **G90** zinc coating, complying with ASTM A 653/A 653M.

2.6 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 CURTAIN ACCESSORIES

- A. Weatherseals: Equip door with weather-stripping gaskets fitted to entire perimeter of door for air-resistant installation unless otherwise indicated.
 - 1. At door head, use **1/8-inch**-thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, **1/8-inch**-thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft.** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **25-lbf** force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include three months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components,

lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

END OF SECTION 083313

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
- B. Related Sections:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
 - 2. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
- C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
 - 1. Permanent lock cores to be installed by Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- a. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
- b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
- c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
- d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) List of related door devices specified in other Sections for each door and frame.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- F. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant [and Owner's security consultant]. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.
 - 4. Requirements for access control.
 - 5. Address for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum

requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches ; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

- B. Pin-and-Barrel-Type Hinges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Deadbolts: Minimum 1.25-inch bolt throw.

- C. Lock Backset: 2-3/4 inches , unless otherwise indicated.

- D. Lock Trim:

1. Levers: Cast.
2. Knobs: Wrought.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturer: Same manufacturer as for locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
 - 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.

2.7 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.8 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.9 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed **0.50 cfm per foot** of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.10 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.11 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and

hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 - 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.12 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches .
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

END OF SECTION 087100

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. .
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

- C. Colors: As selected by Architect from manufacturer's full range.

2.2 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No. 4.
 - 4. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. High-Build Latex System: Dry film thickness of not less than **10 mils**.
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. .
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Room-identification signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for signs.

2.2 SIGNS

- A. Room-Identification Sign-: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Beveled.
 - b. Corner Condition in Elevation: Square.
 - 2. Mounting: Manufacturer's standard method for substrates indicated with
 - 3. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-plastic toilet compartments configured as urinal screens.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS-

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley or comparable product by one of the following:
 - 1. Bobrick
- C. Urinal-Screen Style: Wall hung.
- D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer.
 - 1. Polymer Color and Pattern: Matching pilaster.
- E. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.

- B. Aluminum Extrusions: **ASTM B 221** .
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: **1/2 inch** .
 - b. Panels and Walls: **1 inch** .
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open

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approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
- B. Related Sections:
 - 1. Section 088300 "Mirrors" for frameless mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Combination Toilet Tissue Dispenser:-
 - 1. Basis-of-Design Product: Bobrick B-3888.
 - 2. Mounting: Partition mounted, dual access with two tissue rolls per compartment.
 - 3. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch-diameter tissue rolls.
 - 4. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 6. Lockset: Tumbler type.

B. Liquid-Soap Dispenser-:

1. Basis-of-Design Product: Bobrick B-2112.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Horizontally oriented, surface mounted.
4. Capacity: 40 oz.
5. Materials: Stainless Steel.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

C. Grab Bar <Insert drawing designation>:

1. Basis-of-Design Product: Bobrick.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches .
5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit-:

1. Basis-of-Design Product: Bobrick B-165 2436.
2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lbf**, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."
 - 2. Section 233813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.3 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
- B. Regular Dry-Chemical Type-: UL-rated- nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS-

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: **54 inches** above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

RESTROOM BUILDING FOR CITY OF DEER PARK SOCCER COMPLEX

Mechanical/Electrical Specifications



B.J. Hendrix

03/08/2017

F-4095

MEP/ENERGY CONSULTANTS



COMMISSIONING • FIELD INVESTIGATIONS

115 E. MAIN
ROUND ROCK, TX 78664
F-4095

DIVISION 20, 22 & 23

RESTROOM BUILDING FOR

CITY OF DEER PARK SOCCER COMPLEX

MECHANICAL SPECIFICATIONS

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B.J. Hendrix

03/08/2017

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SECTION 20 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work of Division 20-24 consists of providing labor, materials, products, and all operations required for the complete operating installation of all mechanical systems as shown and specified, in strict compliance with applicable drawings, specification, terms and conditions of the contract and all applicable codes and ordinances governing the installation of the various mechanical systems. Contractor shall provide all equipment and materials necessary and usually furnished in connection with such work and systems whether or not specifically mentioned in the specifications or on the drawings. All work shall be fully correlated with the work of other crafts. This section of Division 20-24 is a part of all other sections of Division 20-24.
- B. Each Contractor shall study the Contract Documents included under this contract to determine exactly the extent of work provided under this contract, as well as to ascertain the difficulty to be encountered in performing the work on the drawings and outline hereinafter and in making new connections to existing utilities, installing new equipment and systems and coordinating the work with the other Trades.
- C. Notwithstanding any approvals or instructions which must be obtained by the Contractor from the Architect in connection with use of premises, the responsibility for the safe working conditions at the site shall remain that of the Contractor's, and the Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.
- D. The Agreement Forms, Uniform General Conditions, Supplementary Conditions, Division 00 and Division 01 of the specifications shall apply to the work specified in Division 20-24.
- E. Additional Site Visit Costs: Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.
- F. The Contractor shall obtain and pay for all permits and fees associated with his work.
- G. REMODEL WORK: COORDINATE ALL CONNECTIONS OF NEW EQUIPMENT WITH EXISTING SERVICE. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT, MATERIALS, AND INCIDENTAL ITEMS REQUIRED TO MAKE SYSTEM COMPLETE AND OPERABLE.
- H. **NO TOXIC OR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED. ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
- I. **An extra copy of all Field Reports shall be kept in a separate notebook set up in the Construction Manager's Trailer. Contractors shall use these reports to check off that each individual item noted has been completed. Each item shall be initialed and noted when completed. Use this notebook to keep record of all test and results (i.e. wastewater test, water line tests, etc.**

J. **Drawings:**

Architectural Background Files – Architectural Revit Models and CAD files to be used for background files, MEP drawings are not background files. Architectural Revit Models and CAD files are used for shop drawings backgrounds. They must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of \$500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

MEP CAD Files that will be released.

- If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- Fire Alarm/Fire Sprinkler/Intercom etc... Contractors must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read.

1.02 PRE CONSTRUCTION MEETING

- A. DDC Contractor, Mechanical Contractor, Test and Balance Representative and representatives for each type of HVAC gear that requires interface beyond 'on/off' control will meet in the office of HCE prior to initial control submittal.
- B. The purpose of this meeting is to introduce all representatives who will need to coordinate with each other to insure a working project.
- C. Each representative is to come prepared with sequences of operation, schematics and written instructions as to which points require what type of signal for each function and how tie-ins and integrations are to occur. If pulsed signals are required to keep a device on, bring it to the attention of the team and provide specific information. Do not assume others understand the inner workings of your gear or controls. Discuss exactly what type signals are acceptable to gear and how to set it up to receive and act on that signal.
- D. Newer multistage air volume split systems, RTU's, etc. have different sequences and control tie-ins than older conventional units. Exact requirements for a given type and brand of equipment must be coordinated by the equipment supplier with the Controls Contractor and with the Test and Balance Contractor.
- E. Test and Balance Contractor must verify air flow and delta T's at every stage of unit capacity to insure that unit is providing the correct CFM based on the capacity stage it is on so that the unit does not end up with low stage cooling and high stage blower which will not dehumidify. Equipment supplier is to provide Test and Balance Contractor with a quick start up guide to show where and how to set up fan speed selections and outside air dampers so that only minor balancing occurs at dampers serving grilles.

RESTROOM BUILDING

1.03 SITE INSPECTION

- A. Prior to bidding the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.
- B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.04 RELATED WORK SPECIFIED ELSEWHERE

- A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.
 - 1. Electrical Specifications: Division 26-28.
 - 2. Mechanical, Electrical, Plumbing Drawings
- B. Unless otherwise indicated on the Electrical Drawings or in Mechanical Specifications, provide all mechanical equipment motors, motor starters, disconnect switches, thermal overload switches, control relays, time clocks, thermostats, motor valves, damper motors, electric switches, electric components, wiring, and any other miscellaneous Division 20-24 controls.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere in these documents.
- D. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than plus or minus 10 percent of rated voltage.
- E. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- F. Size motors for 1.15 service factor, not to exceed 40 degrees temp. Rise above ambient.
- G. Provide self-resetting thermal overload switch for fractional horsepower motors.
- H. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.
- I. **The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings and any change in equipment and/or motor size or type brought on directly or indirectly by a substitution of mechanical equipment having**

characteristics requiring a change, shall be the responsibility of the Mechanical Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show any deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

- J. Mechanical contractor assumes requirements of Controls Contractor when there is no separate Controls Sub-Contractor.**

1.05 WORK NOT INCLUDED

- A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

1.06 SPECIFICATION TERMINOLOGY (Definitions)

- A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.
- B. "Furnish" means to purchase and deliver material as shown and specified, including mark-ups, and cart the material to an approved location at the site or elsewhere, as noted or agreed.
- C. "Provide/Install", as used in these specifications, means furnish all material, labor, sub-contracts, and appurtenances, including mark-up required for a complete, operating, finished system.
- D. "Rough-in and Connect Only" means provide an appropriate system connection, such as supplies with stops, continuous wastes with traps, shut-off valves required, and all piping connections, testing, etc., for proper operation, and to install equipment furnished. Equipment furnished is received, uncrated, assembled and set in place by supporting crafts unless they make prior arrangements to hire the mechanical installer for this work.
- E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. It shall also be no more than four feet (4') above a ceiling.
- F. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction, or damage to the surrounding installation.
- G. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.
- H. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

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- I. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit. "Piping" includes, in addition to piping, all fittings, valves, hangers and other accessories relative to such piping.
- J. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, crawl spaces, etc.

1.07 DIAGRAMMATIC DRAWINGS

- A. Drawings and specifications encompass a system that will integrate with the structural, electrical, and Architectural design of the building.
 - 1. Drawings and specifications are complementary, each to the other; what is shown on one is as binding as if called for in both.
 - 2. Where drawing details, plans, and/or specification requirements are in conflict, and where conduit, duct and piping sizes of the same run are shown to be different between plans and specifications or details, the most stringent requirement will be included in the Contract. Systems and equipment called for in the specification and/or shown on the drawings shall be provided under the contract of each Trade as if it were required by both the drawings and the specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to the Architect's attention for direction as to what is to be provided.
- B. The drawings are partly diagrammatic in character and do not show exact locations, all offsets or give exact elevation in piping, fittings, duct, conduits, etc. Also, the drawings do not necessarily show in minute detail all features of the installation. Contractor shall physically arrange the systems to fit in the space available and shall carefully investigate structural and finish conditions, arrange work accordingly and provide a complete and satisfactorily working installation. Provide all work shown on the drawings and specified, unless otherwise stated. No subsequent allowance will be made due to failure to coordinate work prior to installation.
- C. The Architectural, Structural, Civil and Electrical plans and Specifications and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Mechanical Drawings and shall be complied and coordinated with in every respect. All drawings and specifications mentioned above shall be examined by all bidders. Failure to examine all drawings for coordination and quantities shall not relieve the Contractor of responsibility and no subsequent allowance for time or money will be allowed.

1.08 MATERIAL AND EQUIPMENT SUBMITTALS

- A. Submittals: Provide submittals for all products and systems described in Division 20-24 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.
- B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) cover will be returned and required to be broken into separate submittals.** The Engineer's check will be general and

does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

- C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**
- D. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**
- E. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section. Separate PDFs for each Submittal number.**
- F. **HARDCOPY SUBMITTAL REQUIREMENT: Hardcopy submittals will not be required by Engineer.**
- G. **PDF SUBMITTAL REQUIREMENT:**
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected.**

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays cause by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

- H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc. will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**
- I. **SUBMITTALS WILL BE RETURNED IN ORDER OF CONSTRUCTION OF THE PROJECT, NOT NECESSARILY IN ORDER SUBMITTED.** If all sections are submitted under one binder and transmittal, each section will be returned at the appropriate time for construction phasing. Mechanical Equipment will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Mechanical Equipment, Mechanical Controls and Plumbing Fixtures may require extended review time. **IF SUBMITTALS ARE SUBMITTED EARLY RELATIVE TO CONSTRUCTION PHASING, SUBMITTALS MAY BE HELD, REVIEWED AND RETURNED AT THE APPROPRIATE TIME FOR CONSTRUCTION PHASING, NOT NECESSARILY 2 WEEKS.**

- J. DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications submittal will be required. (Write summary sheet of deviations and highlight items that are different to allow for proper review.):**

Isolators	Fire Smoke Dampers / Details
Relief Valves	Valves
Insulation	Gauges
Spin-in Fittings	Flexible Duct
Fire Dampers Installation Detail	Volume Damper
Fire Damper	Air Extractors
Valve Tag / Markers	Access Panels
Flexible Connector	Pipe Identification / Labels
Grease Traps	Duct Tape

- K. PDF Submittals Allowed for Product Cut-Sheets for are limited to the following items: Separate PDF for each Submittal number is required.**

Mechanical/Electrical Coordination Sheet	
Fire Sprinkler Product Data	Condensers
Internal Lining	Metal Jacket & Fittings
Exhaust Fans	Exhaust/Relief Caps
Supply Fans	Grilles/Registers/Diffusers
Unit Heaters	Pumps
Water Heaters	Plumbing Fixtures and Trim
Cleanouts	Floor Drains
Condensing Units/Heat Pumps	Piping

- L. Data Required for Review: Mark submittal literature and shop drawings clearly by individual sections, and include all equipment and material shown on drawings and specified. ANY DATA NOT CLEARLY MARKED OR NOT APPROPRIATELY SUBMITTED WILL BE RETURNED WITHOUT CHECKING. Indicate the following:**

1. Specification reference and/or drawing reference for which literature is submitted for review with an index, following specification format, and item by item identification.
2. Manufacturer's name and address, and supplier's name, address, and phone number.
3. Catalog designation or model number.
4. Rough-in data and dimensions.
5. Performance curves and rated capacities with performance data marked.
6. Motor characteristics and wiring diagrams.
7. Operation characteristics.
8. Complete customized listing of equipment, characteristics, accessories, etc., specified. Indicate whether item is "As specified." Mark out all non-applicable items. The terminology "As specified" used without this customized listing is not acceptable.

9. Wiring diagrams for the specific system operation. Complete wiring with diagrams showing all connections to each type of actual equipment being installed on project, complete with part numbers of controls for each type of equipment.
 10. **Submit written sequence of operation for all modes of operation for each piece of mechanical equipment. Give narrative explaining exactly what control signals are required to activate each mode of a particular unit's operation. Include information about which signals override others internally (when applicable). Submit this information with equipment submittal and provide a copy to the Controls Contractor so it can be integrated into the control scheme and control submittals. Indicate whether 24 VAC, 4-20 MA, 0-10VDC or line voltage is required for controls.**
 11. **Provide HVAC equipment with a controls interface that is suitable for connection to a standard conventional thermostat and/or non-proprietary DDC control systems.**
 12. **Ductwork Shop Drawings: Engineer requires 1 (one) HARDCOPY, full-size at 1/8" scale, sheets size to match project for engineer review and engineer records. Additional copies per Architect and Owner requirements. PDF's will be required for owner and architect records.**
 13. **BREAKOUT SUBMITTALS INTO PRIORITY ITEMS.**
- M. **Contractor to submit "Mechanical/Electrical Equipment Coordination Sheet" with equipment submittal for all HETD's, RTU's, GU's, AHU's, CU's, HP's and MAU's. Reference chart at end of section.**
- N. When requested, present samples of all materials proposed for use to the Engineer for his approval.
- O. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.
- P. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.
- Q. **Substitutions:** ("Substitution Request" form must be submitted)
1. Equipment listed as equal is indicated to be equal in quality to equipment designed around. It does not mean equal in dimension or fit. It is the Contractor's responsibility to confirm dimensional differences and space requirements.
 2. Request for proposed substitution of materials, methods, or processes shall be made to the Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.
 3. **Equal Materials:** It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity, and other characteristics.

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4. Acceptance of substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and of work on schedule.
5. Where equipment of the acceptable manufacturers requires different arrangement or connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor proposing substitutions shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under other Sections, including location of rough-in connections by other Trades, conduit supports, insulation, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.
6. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**
8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**
 - a. Mechanical Equipment
 - b. Contractor Cost Savings Packages Requiring Substantial Review Time

1.09 SHOP DRAWINGS REQUIRED

- A. **Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination. Provide shop drawings for all products, ductwork, systems, system components and special supports which are not standard catalog products and which may be fabricated for the Contractor or by the Contractor. Show top and bottom elevation of ductwork and equipment as it will be installed. Show offsets required to miss structural and other items of interference. Identify all shop drawings as to which section and paragraph of the specifications and/or drawing number the item is covered under. Ductwork layout/shop drawings to be done at a minimum 1/8" = 1'-0" scale. AHU's, CU's, HP's, RTU's, etc. are to be shown actual scaled size and configuration of the actual equipment being used.**
- B. Architectural Revit Models and CAD files to be used for backgrounds in preparation of ductwork and sprinkler shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

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- C. ALL SHOP DRAWINGS OF MECHANICAL ROOMS/MEZZANINES SHALL SHOW ALL FLOOR DRAINS, HVAC, PLUMBING, AND ELECTRICAL EQUIPMENT, INCLUDING ELECTRIC PANELS, TRANSFORMERS AND DISCONNECT SWITCH LOCATIONS. COORDINATE WITH ELECTRICAL AND PLUMBING CONTRACTOR.
- D. Provide roof shop drawing indicating dimensioned locations and sizes for all roof mounted equipment, supports, openings and plumbing vents in ample time for proper coordination of all trades.
- E. Submission of copies of the Engineer's drawings does not constitute shop drawings and is not acceptable.
- F. Submittal of complete engineering submittal data for products and equipment shall be made in sufficient copies to provide one (1) hardcopy of all data to be retained by the Engineer, additional copies as required by the Contractor, Architect and Owner. Provide an electronic copy in PDF format and CAD if available for record keeping purposes for Engineer, Architect, and Owner with close out documents described elsewhere in specifications.
- G. **General Contractor shall transmit a CAD copy of ductwork shop drawings to sprinkler contractor prior to submission of sprinkler shop drawings.**
- H. Ductwork shop drawings shall be submitted and reviewed prior to any ductwork being installed.
- I. **MECHANICAL CONTRACTOR MUST SUBMIT "MECHANICAL/ELECTRICAL COORDINATION SHEET" WITH MECHANICAL EQUIPMENT SUBMITTAL FOR PROPER COORDINATION PURPOSES WITH ELECTRICAL CONTRACTOR FOR ACTUAL EQUIPMENT BEING INSTALLED OR SUBMITTAL WILL BE REJECTED.**

1.10 RECORD DRAWINGS

- A. Reference requirements stated elsewhere in the Specifications.
- B. THE CONTRACTOR SHALL TAPE ALL ADDENDA'S ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THE CONTRACTOR HAS COMPLIED WITH THIS REQUIREMENT.
- C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the General's site trailer and marked up weekly as the work progresses, to show exact dimensioned location and routing of all mechanical work which will be permanently concealed. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Show the location of all valves and their appropriate tag identification. Indicate locations of all existing active and inactive piping uncovered during construction. **Keep marked up set at site for review at site meetings.**
- D. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed for draw requests. They shall be inspected periodically by the Architect and Owner's Representatives, and they shall be corrected immediately if found either inaccurate or incomplete. **This procedure is mandatory.**
- E. The Contractor shall be responsible for updating and/or marking all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job, marked up As-Built Drawings shall be

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submitted to the Architect for final review and comment. These corrected prints together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

- F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contractor shall provide pdf copies/scans for owner record purposes.
- G. The Contractor shall bear all the costs of producing the "Record Drawing Set".
- H. All equipments **model and serial numbers** must be included on start up forms turned in to the owner. For split systems, this includes all model and serial numbers for all indoor sections or components as well as outdoor units. These are required for owner inventory and for processing of any utility rebate forms. Utility rebates require the model and serial numbers associated with a given unit number to match in case the job is spot checked prior to issuing a rebate

1.11 CODES, REGULATIONS AND ORDINANCES

- A. All work shall comply with the current applicable local, state and federal codes and ordinances. Follow recommended practices as set down by ASME, SMACNA, ASHRAE, NFPA, applicable Building Code, applicable Mechanical Code, applicable Plumbing Code, National Electrical Code (NEC), AGA, ADA AND OSHA, as they apply to this project, except in cases where local statutes govern. The contractor shall verify with the latest adopted local codes, ordinances and amendments that apply to this project with the authority having jurisdiction. **PROVIDE LOCKING REFRIGERATION ACCESS PORT CAPS FOR ALL EQUIPMENT WITH REFRIGERANT LOCATED OUTDOORS ON GROUND OR ON ROOF.**
- B. In cases of difference between Building Codes, State Laws, Local Ordinances and Industry Standards and the Contract Documents, each Subcontractor shall promptly notify the Architect in writing of any such difference, as applicable to his work.
- 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.
- D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building codes, State laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

1.12 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

- A. **All equipment and materials shall be protected from physical, moisture absorption, metallic corrosion and weather damage from the time of delivery until completion of the project. This includes erection of temporary shelters and covering items in the building with protective covering. Store items subject to moisture damage such as controls in dry, heated space. Failure to comply with the above to the satisfaction of the Owner/Architect will be sufficient cause for the rejection of the equipment or material in question. Upon such rejection, the damaged equipment or material will be completely replaced with new by the Contractor at no charge to the Owner.**
- B. **Provide covers on all ends and openings of pipes, conduits, ducts, etc. to keep out insects, dirt, dust and debris during entire construction process. This includes properly covering unassembled ductwork, etc. stored on jobsite prior to installation.**

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- C. The Manufacturer's directions are to be followed from delivery, storage, protection and installation of equipment and materials. Notify the Architect in writing of conflicts between requirements of Contract Documents and manufacturer's direction.
- D. Large pieces of equipment which are too large to permit access through doors, stairways or access opening shall be placed in the space before enclosing the structure. After equipment is placed, it shall be thoroughly protected from damage.

1.13 CLEAN-UP

- A. Remove debris and waste materials from within the construction areas and transport off-site, daily.
- B. Keep the construction area clean, free from hazard, and orderly arranged.
- C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.
- D. Dispose of waste materials in accordance with all regulations which govern.
- E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.
- F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.
- G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Unless otherwise indicated, provide only new equipment and materials.
- B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.
- C. All materials furnished under these specifications shall be the standard product of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.
- D. **GUARANTEE**
 - 1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical, HVAC, Plumbing and Fire Protection Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents. **In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect, and shall remain in effect for a period of TEN (10) YEARS thereafter.**

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2. All materials, items of equipment and workmanship furnished under each Section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other system resulting from this failure.
3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.
5. Additional extended guarantee's required for work on this project. The additions and/or extensions to the standard one year guarantee previously described are to be provided in writing, by the manufacturer or an approved insurance underwriter. The guarantee is to cover all parts and/or labor as specified below.

Master Extended Guarantee List:

- a. All comfort air conditioning and heat pump compressors are to have an additional four (4) year parts only guarantee. (Non-prorated)
6. Furnish, before the final payment is made, a written guarantee covering the above requirements.
7. Additional/extended guarantees listed above are Non-negotiable, and can't be amended through the submittal process.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

- A. The Contractor shall notify the General Contractor and other Subcontractors in ample time of the location of all chases, sleeves and openings required in the construction for the proper installation of his work. The Contractor shall do all core drilling of individual holes and all cutting for his work except square or rectangular openings in the structural slabs which shall be cut by the Contractor at locations shown on the drawings. In no case, however, shall a beam or column be cut without the approval of the Project Structural Engineer.
- B. On completion of this work or as work progresses the Contractor shall make all repairs and do all patching required as a result of the work under this contract. All patching shall be performed in a manner that will restore the surrounding work to its original conditions and to the satisfaction of the Owner.
- C. Any cutting and patching necessary as a result of the Contractor's failure to notify the General Contractor of all the required openings shall be at the expense of the Contractor.

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3.02 OBLIGATIONS/RESPONSIBILITIES

- A. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.
- B. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures, and for coordinating all portions of the work under his Contract.
- C. The Contractor shall provide, without extra charge, all incidental items required as a part of the work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.

3.03 TESTS AND INSPECTIONS

- A. Schedule, obtain, and pay for all fees and/or services required by local authorities and by these specifications, to test the mechanical systems as specified in these specifications.
- B. Request for Tests: Notify the Architect a minimum of 24 hours in advance of tests. In the event the Architect does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.
- C. Deficiencies: Immediately correct all deficiencies which are evidenced during the test and repeat test until system is approved. Do not cover or conceal piping, equipment or other portions of the mechanical installations until satisfactory tests are made and approved.
- D. Operating Tests: Upon request from the Architect, place the entire mechanical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.
- E. Log of Tests: The Contractor shall set up a testing log form to be kept at the job site with the record drawings. All tests shall have pertinent data logged at the time of testing. Pertinent data is to include: date, time, description, personnel, system tested (and extent), test conditions, test results, etc.
- F. Completion: Upon completion of the mechanical installation, demonstrate to the Architect's satisfaction that the systems have been installed in a satisfactory manner in accordance with the plans, specifications, and applicable codes. Demonstrate dynamic operation of all systems. Show that all controls are operable and are properly adjusted in accordance with the requirements of the final systems balance, that all systems are properly balanced, that all equipment operates properly, that filters and strainers are clean, and that all components of all systems are installed and adjusted for proper operation.
 - 1. Prior to final inspection, all work under this Division to be completed, insure all equipment is operational and final testing and balance reports have been submitted and approved.

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3.04 OPERATING INSTRUCTIONS

- A. Prior to final acceptance, instruct an authorized representative of the Owner on the proper operation and maintenance of all mechanical systems, equipment, and controls under this contract. Make available a qualified technician for each component of the installation for this instruction. Give these operation instructions after the operation and maintenance manuals have been furnished to the Owner. Submit written certification, signed by the Contractor, and an authorized representative of the Owner, that this has been completed.

3.05 COORDINATION OF WORK

- A. Each Contractor shall compare his Drawings and Specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, all trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Each Contractor shall coordinate the location of his systems so that all outside air intakes are located in such a way as to prevent cross-contamination from plumbing vents, flue pipes, exhaust fans, etc. Such a distance shall be not less than 10 feet.
- C. Locations of conduit, ducts, piping, sprinkler heads and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of system shall be determined prior to fabrication or installation. Coordinate routing of major electrical conduits with Electrical Contractor prior to fabrication of ductwork and piping.
- D. Offsets and changes of direction in all conduit, ducts and piping systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.
- E. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems and equipment, as determined by the Architect.
- F. **The HVAC, Plumbing and Fire Protection Subcontractors shall verify with Electrical Subcontractor the available electrical characteristics for all motors and equipment before ordering and submitting of respective gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**
- G. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.
- H. Mechanical Contractor and Controls Contractor shall coordinate all requirements of equipment and controls to insure a fully operational system.

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- I. Coordinate all plumbing rough-in through floor(s) with structural concrete TEE's/structural steel. Do not pass through stem of TEE's.

3.06 OPERATION AND MAINTENANCE MANUALS

- A. Provide one (1) Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records
- B. Operating Sequence and Procedures:
 1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter. Also, include a copy of System Balancing Report.
 2. Typewritten Operating procedures: Write procedures for start-up, operation, and shutdown.
 - a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.
 - b. Shutdown Procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instruction in that order.
- C. Maintenance Instructions:
 1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.
- D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide nearest manufacturers' representatives name, address and phone number.
- E. Shop Drawings: Provide a copy of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturers' brochures or properly identified in a separate subsection.
- F. Spare Parts Lists: Include a list of all equipment furnished for project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or system. Properly identify each part by part number and manufacturer.
- G. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format,

3.07 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical or electrical equipment is operable and it is the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. **All HVAC equipment shall be shut down when painting, sanding and similar construction operations detrimental to the equipment are being done.** The warranty period shall, however, not commence until such time as the equipment is operated

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solely for the benefit of the Owner at his request or as listed in 'C'. Contractor shall clean any ductwork and equipment that is dirty due to equipment operation or improper protection.

- B. Any units that are operated during construction shall have filter media (Fiberbond Dual-Ply DustLok Media) placed over the exterior of return air grilles. Media shall be changed as frequently as required to keep ductwork clean.**
- C. Regardless of whether or not the equipment has been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust the equipment and complete all punch list items before final acceptance by the Owner. The day following final acceptance by the Owner will be the start date of the warranty period.

3.08 RECORD FOR OWNER

- A. Each Contractor shall accumulate and bind in an "Operating and Maintenance" manual the following data to be presented to the Owner at the completion of the Project.
 - 1. All warranties and guarantees and manufacturer's instruction on equipment and material covered by the contract.
 - 2. Approved equipment brochures, wiring diagrams and control diagrams.
 - 3. Copies of approved shop diagrams.
 - 4. Operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
 - 5. Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.
 - 6. Valve tag charts and diagrams herein before specified.
 - 7. HVAC balance and test results.
 - 8. HVAC equipment start-up forms that include model and serial numbers of each piece of mechanical equipment installed, by unit mark number. For split units provide this information for all components.
 - 9. "As-Built" Drawings as specified under "Construction Drawings" (these are not to be bound in the O&M Manual).
- B. Provide reduced set of record drawing (11 x 17) indicating location and mark number of all mechanical equipment.

3.09 SITE OBSERVATION

- A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.
- B. It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense.**

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- C. The final acceptance of the work will be made jointly by the Architect and the Owner.

3.10 MECHANICAL/ELECTRICAL

- A. **THIS IS TO BE DONE PRIOR TO SUBMITTING HVAC EQUIPMENT.** Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for actual equipment (HETD's, RTU's, AHU's, CU's, HP's, HRU's, Airhawks, AFU's, MAU's, etc) being installed. Reference chart at end of section. This is for Contractor coordination purposes.

MEP/ENERGY CONSULTANTS



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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

- A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.
- B. 2 Submittal CATEGORIES (Reference Specifications)
 - a. Not required unless deviating from specification
 - b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:

For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures

Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:

Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

- C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.
- D. Time Critical Submittal Coordination Items
 - Mechanical to provide to General Contractor for Structural Roof Coordination**
 - a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.
 - Mechanical to provide to General and Electrical Contractors for Gear Coordination**
 - b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

- E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.
- F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.
- G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.
- H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."
- I. Call before submitting a written RFI.
- J. All formal Job emails must come from Architect.
- K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

- A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.
- B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.
- E. Schedule and Details sheets will not be released.

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SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

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The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph: _____

Drawings and Details Affected: _____

Proposed Substitution/Description: _____

Installer's Name: _____

Manufacturer's name: _____

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____ # of pages including cover)

Why is Substitution Being Submitted?

- ☐ Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
- ☐ Specified product is not available. Explain in detail as attachment.
- ☐ Cost Savings to Owner. Indicate comparative cost analysis as attachment.
- ☐ Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

- A. Does substitution affect dimensions shown on drawings? ☐ No ☐ Yes
- B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐ No ☐ Yes
- C. What affect does substitution have on other trades?
- D. Differences between proposed substitution and specified item?
- E. Indicate how proposed substitution meets LEED requirements. (if applicable)
- F. Manufacturer's guarantees of proposed and specified items are:
- ☐ Same ☐ Different (explain on attachment)

The Contractor and Subcontractor certifies:

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

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

For A/E Use: SR# _____

- ☐ Accepted ☐ Accepted as Noted
- ☐ Not Accepted ☐ Received Too Late
- ☐ Incomplete Information
- ☐ No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:

- ☐ FILE ☐ OWNER ☐ CONTRACTOR
- ☐ ENGINEER ☐ _____



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SECTION 20 01 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products, and methods of execution which are typical throughout the mechanical work of this project. Additional requirements for the specific systems will be found in the sections specifying those systems, and supersede these requirements.
- B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 JOB CONDITIONS

- A. Obtain approval from Architect prior to cutting any structural elements or furring members.
- B. Structural Interferences: Should structural members prevent the installation of piping, ducting or equipment, notify the Architect before proceeding.
- C. Consider minor changes in position of equipment, piping, or ducting, as part of the contract at no additional cost to the Owner.
- D. Coordinate with Structural and Architectural work to determine acceptable locations for sleeves and supports which are required but may not be specifically shown on the plans. SCHEDULE INSTALLATION OF SLEEVES AND SPECIAL SUPPORTS IN MANNER TIMELY TO THE WORK OF OTHER CRAFT. Anticipate minor offsets necessary for proper coordination with other work, and reroute systems appropriately.
- E. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Civil and Electrical Drawings where such drawings affect his work.

1.03 DIMENSION AND FIT

- A. Cut materials accurately from measurements taken on the JOB SITE.
- B. Do not spring or bend pipe to fit conditions or make up joints.

1.04 INTERFERENCES

- A. Interferences between piping and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed.
 - 1. Building Lines
 - 2. Structural Members
 - 3. Soil and Drain Piping
 - 4. Vent Piping

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5. Refrigerant Piping
6. Supply, Return, Ductwork
7. Exhaust Ductwork
8. Domestic Hot and Cold Water Piping
9. Electrical Conduit
10. Fire Protection Piping

1.05 SERVICEABILITY OF PRODUCTS

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of piping, ductwork, equipment, coils, system components, and other products to allow proper service of all items requiring periodic maintenance or replacement.
- C. **Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.**

1.06 ACCESSIBILITY OF PRODUCTS

- A. Arrange all work to provide permanent, convenient, and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.
- B. Provide access doors in ceilings, walls, floors, etc., for access to traps, valves, dampers, automatic devices, and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.07 ROUTING

- A. Route all pipelines and ductwork parallel with building lines, and as high as possible, except where under ground or shown otherwise on the plan.
- B. Route piping and ducts to clear all doors, windows, and other openings and to avoid all other pipes and ducts, light fixtures, and similar products.
- C. Conceal all pipes and ducts where routed through finished areas, unless authorized by Architect or otherwise indicated on plans.

PART 2 - PRODUCTS

2.01 MATERIAL PRODUCTS

- A. Provide all products new, unused, and undamaged, of standard manufacture, and of latest design and best quality. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

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- B. When a manufacturer's name appears in these specifications or schedule, it is not to be construed that the manufacturer's material does not have to meet the full requirements of the specifications or that his standard catalogue item will be acceptable.
 - C. All equipment installed on this project shall have local representation, local factory authorized service and local stock of repair parts.
 - D. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.
- 2.02 Where more than one type of material (i.e., cast iron or PVC) is specified, the Contractor may choose one type; however, he must state which type of material he proposes to use in his submittal. **ONLY ONE TYPE OF MATERIAL MAY BE USED IN A SPECIFIC PIPING SYSTEM, UNLESS SPECIFICALLY NOTED OTHERWISE. (I.E. WHEN DIFFERENT SIZES OF THE SAME TYPE SYSTEM REQUIRE DIFFERENT MATERIALS PER SPECIFICATIONS.)**

2.03 PIPE AND FITTINGS

- A. Steel Pipe: **All steel piping and fittings are to be domestically manufactured (USA).**
 - 1. **PROVIDE DOCUMENTATION IN SUBMITTAL STATING LOCATION OF MANUFACTURING.**
 - 2. Threaded: Schedule 40, ASTM A53 grade B or ASTM A120, American Standard pipe thread. Pipe 2" and under to be made up with threaded fittings.
 - 3. Welded: Schedule 40 black, ASTM A53 grade B or ASTM A120, ANSI B16 butt weld fittings of type and wall thickness to suit pipe. Weld-O-Lets and Thread-O-Lets may be used on pipe 2-1/2" and larger where branch is a minimum of two pipe sizes smaller than main. Pipe 2-1/2" and over to be made up with welded fittings. Pipe 2" and under to be made up with threaded fittings.
 - 4. Grooved Pipe: Schedule 40 ASTM A120 or ASTM A53 grade. Standard cut or rolled groove to coupling manufacturer's specifications. Do not use in systems exceeding 200° F. operating temperature.
 - a. Couplings: Standard weight with gasket selected by manufacturer for service intended.
 - b. Fittings: Full flow malleable iron, ductile iron or steel.
 - c. Submit calculations of expansion allowance of joints and obtain approval prior to eliminating any special expansion compensators, swing joints, flexible connections, or vibration isolators.
 - d. Manufacturers: Victaulic or Gruvlok.
- B. Copper pipe:
 - 1. Type "K" or "L" hard drawn copper with wrought copper fittings with openings machined to accurate capillary fit for the pipe. Pipe to conform to Standard Specifications for copper water tube. Type 'M' may only be used for A/C condensate drain lines.

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2. Use "lead free" (0.00% lead content) solder for all domestic water piping. Submittal on the product to be used must include this information. Lead free solder to conform to ASTM B 32 and flux to conform to ASTM B 813. Soldered joints must be done in accordance with ASTM B 828. Lead free shall mean a chemical composition equal to or less than 0.2 percent lead.
 3. Solder joints using 50/50 lead tin solder for systems operating below 180° F.
 4. Solder joints using 430 silver solder for systems operating at 180° F. or above.
- C. Domestic Copper Pipe (2" and larger): (Contractor Option)
1. Copper tubing systems from two inches (2") through six inches (6") shall be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure-responsive gasket along with grooved end copper fittings.
 2. All copper tubing shall be prepared in accordance with the manufacturer's published specifications.
 3. Couplings - Coupling for copper shall consist of cast ductile iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts and bolts to secure unit together.
 - a. Housings - Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) with a copper alkyd enamel paint coating.
 - b. Gasket - Gaskets shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the copper tube size (CTS) outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000.
 - c. Water Service - Gaskets supplied for water services from -30° F to +230° F shall be a Grade "E" EPDM compound, with copper color code, molded of materials conforming to ASTM D-2000, designation 2CA615A15B44F17Z, recommended for hot water service within the specified temperature range.
 4. Flanged Connections: Shall be, engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer to supply standard flange bolts. Flange casting shall be as in 3, a. above with a corresponding gasket as in 3, b.
 5. Fittings - Fittings shall be full flow copper fittings with grooves designed to accept grooved end couplings.
 - a. Standard fittings shall be two inch (2") through four inch (4") copper per ASTM B-75 alloy C12200; five inch (5") through six inch (6") bronze sand castings per ASTM B-584-87 copper alloy CDA 844 (81-3-7-9).
 6. Butterfly Valves – Lug style, grooved end butterfly valves are to be rated for bi-directional dead end service to the full working pressure of the valve with the down stream flange removed.
 - a. 2 ½-6" valves shall have either lever lock handles or gear operators. Valves in 2 ½" or 3" sizes may have two-position handle as per service requirements and manufacturer's recommendations.

RESTROOM BUILDING

- 1) Valve housing shall be bronze per CDA-836 (85-5-5-5).
 - 2) Disc shall be aluminum bronze or ductile iron.
 - 3) Operator bracket shall be steel-black enamel coated.
 - 4) Operator - Two (2) position detent or manual lever lock shall be steel-black enamel coated.
 - 5) Seat to be molded to the body of the valve for bi-directional dead end service
7. Tube Preparation: Copper tube shall be to ASTM B-88 (drawn tubing) and prepared in accordance with the latest published manufacturer's specifications, as applicable. Pressure ratings and end loads for roll grooved copper tubing are based upon test on copper tube prepared in accordance with manufacturer's specifications using manufacturer's approved rolled grooving tool for grooving copper tube.
8. Assembly: Couplings, fittings, adapters and tubing shall be assembled in accordance with the latest published instructions from the manufacturer for the particular product installed.
9. Reference hanger spacing in specification. In addition, use the following recommendations for support installation:
- a. Copper tubing joined with grooved type couplings requires support to carry the weight of tubing and equipment. The support or hanging method must be such as to eliminate undue stresses on joints, tubing and other components.
 - b. The support system for mechanical grooved type tubing couplings must consider some of the special requirements of these couplings.

2.04 VALVES

- A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 psig steam or 150 psig W.O.G. All valves on insulated lines to have extended handles to allow operation without disturbing insulation seal.
- B. Manufacturer: Nibco, KITZ, Jenkins, Milwaukee, Stockham, other recognized manufacturer of equal reliability.
- C. Gate Valves, 2½" and Larger: Iron body, bronze trim, rising stem, flanged.
- D. Globe Valve 2" and Smaller: Teflon disc, bronze body, bronze trim.
- E. Ball Valves 3" and Smaller: Brass or bronze body, virgin TFE seat rings, blow-out proof stem, reinforced thrust washer, ¼ turn full open/full close, FULL PORT, CSA-ULFM approval.
- F. Globe Valve 2½" and Larger: Iron body, bronze trim, Buna-N disc, flanged, bronze disc hot water, Buna-N disc cold water.
- G. Swing Check Valves 2" and Smaller: Bronze body, horizontal swing, Y-pattern, renewable disc.

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- H. Swing Check Valves 2½" and Larger: Iron body, horizontal swing, bolted bonnet, renewable seat and disc, flanged, non-slam type.
- I. **Butterfly Valves: Reference Section 2.03, C. above.**
- J. Drain Valves: Hose end gate valve or gate valves with hose connection. Do not use sillcocks in lieu of drain valves.
- K. Valves Specified Elsewhere: Provide special valves such as motor operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.
- L. **USE FULL PORT BALL VALVES RATED FOR SERVICE INTENDED FOR ALL ISOLATION VALVES THREE INCHES (3") AND SMALLER.**

2.05 BALANCING VALVES

- A. Provide balancing valves for all cooling and heating flows and at all pump discharge lines. Provide balancing valves for all potable hot/tempered water recirculation systems and at TMW's as required by manufacturers written instructions.
- B. Valves sized for maximum 1 pound pressure drop at design flow with valve wide open. Submit schedule of balancing valves indicating sizes, flow ranges and pressure drop curves.
- C. Valves, rated at not less than 150 psi, furnished with three self-lubricating bronze or teflon-coated stainless steel bushings with shaft seals at each bushing; seals to be hard back resilient type and shall be field replaceable; discs shall be bronze, aluminum-bronze, or semi-steel with welded nickel edge.
- D. Valves 4" and smaller insulated with removable foam polyurethane Dry Cap. Series 400.
- E. Valve 2½" through 6" shall be lever operated. Butterfly valves, lug body indicating locking type with adjustable memory stop, may be used at Contractors option at each location where gate valves or globe valve is indicated on water line 2½" and larger.
- F. On valves 2" and smaller, use Flow Set balancing valves system consisting of: 300 lb. rate flow measuring bronze body ball valve with integral venturi and temperature and pressure taps; flow setting 300 lb. butterfly valve assembly with stainless steel disc and Viton seats dual-core temperature/pressure test port and external lockable memory stop. Furnish valves with insulation sleeve for ease of access to temperature/pressure ports and to allow adjustments of valve handles without removing insulation. Manufacturer: FlowSet by Olympic Valve, Inc. At the Contractor's option, use Presso B-Plus balancing valves with extension handle and extension P/T plugs.
- G. Manufacturers: DeZurik, Olympic Valve, Inc., Jenkins, Nibco, B & G, Hammond, Presso or approved equal.

2.06 UNIONS

- A. Provide unions adjacent to all tanks and equipment and where required for disconnect and maintenance of equipment.
- B. Union for Steel Pipe: Ground joint malleable iron.
- C. Union for Copper Pipe: All brass.

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- D. Union Between Dissimilar Metals: Dielectric Union designed and advertised to be unaffected by heat, cold or fluid in pipe. EPCO or approved equal.

2.07 MISCELLANEOUS

- A. Escutcheons: Nickel or chrome plate with screws or springs for holding plate in position.
- B. Automatic Air Vents: Hoffman #79, Marsh or equal.
- C. Gaskets: Gaskets 1/16 inch thick for all pipe sizes 10 inches and smaller and 1/8 inch thick for all pipe sizes 12 inches and larger. Gaskets to be ring type between raised face flanges and full face type between flat face flanges with punched bolt holes and pipe opening. Gasket material shall be suitable for the service intended and shall be installed as recommended by the manufacturer. Manufacturer: Crane, John-Manville, or equal.
- D. Strainers: Cast iron or bronze body basket or wye type strainers provided with ½" valved drain and a ¼" air vent cock, unless the strainer design is devoid of air pockets. Strainers shall have removable cylindrical or conical screens of nickel, copper, or brass and suitable flanges or tapings to connect with the piping they serve. Strainers 2½" and larger shall be provided with flanged covers. The free area of each screen shall not be less than three (3) times the area of the strainer inlet and shall be suitable for the service intended. Manufacturers: Crane, McAlear, Sarco or Armstrong.

2.08 MECHANICAL SUPPORTING DEVICES

- A. General:
 - 1. Securely fasten all mechanical work to the structure to prevent hazard to human life and limb, and to prevent damage to products of construction under all conditions of operation.
- B. Pipe Supports:
 - 1. Single Pipes:
 - a. Support all horizontal runs of steel, copper pipe under 2" and all cast-iron soil pipe on suitable hangers spaced not more than 5 feet on centers. Support all steel, and copper piping 2" and larger not more than 10 feet on centers. Support all PVC piping not more than 4 feet on center. Support piping in a manner to prevent binding, undue swing, and the transmission of vibration to the structure.
 - b. Support single pipes from clevis hangers equal to Anvil fig. 260. Install hangers for insulated piping outside the insulation using high density section of insulation and sheet metal shield or saddle. Provide copper plated hangers in contact with copper pipe.
 - 2. Trapeze Hangers: Where pipes are clustered, parallel, and in same plane, they may be supported by trapeze hangers. Provide rods and angle-irons sized to suit load imposed. Minimum channel length to be six inches (6"), maximum rod spacing to be twenty-four inches (24") on center. Piping to be securely attached to trapeze hangers. Provide sheetmetal shield or saddle for all insulated piping running horizontally.

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3. Piping on Walls: Secure with hook-plates, clips or fabricated steel brackets.
4. Supports from Steel Beams and Similar Construction: Use appropriate beam clamps.
5. Provide inserts for poured concrete and expansion bolts for pre-cast slabs.
6. Guide and anchor piping where necessary to control expansion and contraction. Provide supports and hangers with non-corrosive and rust-resistant finish. Galvanize or plate hanger rods after threading. Hangers other than those specified not permitted. **USE ONLY GALVANIZED HANGERS AND HANGER RODS FOR ALL PIPING IN CRAWL SPACE.**
7. Provide inserts for poured concrete and expansion bolts for pre-cast slabs. Use HiltiDrop-in Anchor or Kwik Bolt II Stud Anchor System. Verify allowable place of anchors with Structural Engineer.
8. Provide pipe supports according to the following schedule:

PIPE SIZE - INCHES	ROD SIZE - INCHES
½" through 2"	3/8"
2½" through 3"	1/2"
4" through 6"	5/8"
8" through 12"	3/4"

9. Manufacturers: Anvil International, C&P, Fee and Mason, Elcen or SuperStrut.
- C. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for piping 2-1/2" and smaller. For piping over 2-1/2", up to and including 8" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All pipe stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Walk board to be a minimum of 3" larger on each side than support. Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 6"). Provide supports for piping under 2" at six feet on center. Provide supports for piping 2" and over at eight feet on center. **PIPE PROP will not be acceptable.**
- D. Ductwork Support: Refer to Section 23 30 00-Air Distribution.
- E. Inserts: Provide all inserts required for installation of horizontal piping. In poured concrete provide wrought steel or malleable iron and adjustable type. Where expansion bolts are necessary to secure piping or equipment, use malleable iron type with expansion case, to be inserted by drilling concrete. Power driven inserts not permitted for supporting piping to ceiling.
- F. Miscellaneous Iron and Steel:
1. Provide all steel supports and hangers to support all equipment or materials unless noted otherwise.
 2. All work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and rigidly constructed in a manner to withstand anticipated loads.

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3. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be performed by experienced metal-working mechanics. Members shall be straight and true and accurately fitted.
4. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades.
5. Members shall be generally welded except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.
6. All shop fabricated iron and steel work shall be cleaned and dried and given two (2) coats of weatherproof primer paint on all surfaces and in all openings and crevices.

2.09 ACCESS DOORS

- A. Doors shall be Karp, Inland Steel Products, Milcor, Miami or Walsh-Hannon, constructed of steel with primer coat of rust inhibitive paint, and continuous piano hinge. Doors shall be key operated with flush operated cylinders, keyed alike. Key lock system shall be coordinated with the Owner and shall be approved by the Architect. Provide six (6) keys of type used for access panels for Owner's use. Obtain receipt of key delivery and submit to Architect for record.
 1. Suspended Lath and Plaster Ceilings - Style: "M" with 16 gauge frame, 14 gauge panel.
 2. Masonry Non-Rated Walls - Style: "M" with 16 gauge frame, 14 gauge panel.
 3. Masonry Fire Rated Walls - Fire rated with UL, ½ hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel.
 4. For access doors larger than 16" in either direction, provide two (2) locksets.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTING

- A. Provide equipment concrete pads, treated support runners, roof curb supports, mounting accessories, supports, hanger expansion joints, adapters and any other appurtenances to adapt fixtures and equipment supplied to the conditions of use.
- B. Provide vibration eliminators as specified (if not specified elsewhere use vibration eliminators recommended by equipment manufacturer) at all pieces of equipment subject to vibration. (Exception; curb mounted equipment does not require vibration isolator rails except when specifically scheduled).
- C. Independently support piping and ductwork at equipment so that no weight is supported by the equipment.
- D. Securely fasten fixtures and equipment to the building structure in accordance with manufacturer's recommendation.
- E. Provide steel base plates for floor mounted fixtures and equipment to distribute the weight so that the floor load is not more than 100 lbs. psf, unless special structural reinforcement is submitted for approval.

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- F. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates of at least 1/8 x 10 inch sheet metal or 2 x 10 inch fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.
- G. Electrical conduit shall not be hung from equipment or plumbing piping.

3.02 SLEEVES

- A. Provide sleeves as required where pipes pass through walls, floors, or ceilings. Make sleeves as follows:
 - 1. In non-fire rated bearing walls, foundations, masonry or concrete walls and floors, use schedule 40 black steel pipe.
 - 2. In non-rated construction, use minimum 20 gauge galvanized sheetmetal.
 - 3. In fire rated walls, floors and assemblies, install sleeves as required by UL System Number.
- B. In non fire rated areas install sleeves flush with surfaces. In mechanical rooms or any wet floor where seepage may occur, install sleeve 1 inch above floor and caulk. Caulk both sides of penetration using UL listed one part firestop synthetic elastomer sealant, flexible at normal working temperatures, having smoke developed 50, fuel contributed 50, and flame spread 25 rating. Install thickness per manufacturer's recommendation. Manufacturer: Dow Corning FireStop 2000 Sealant, Flame Stop V, 3M: CP-25.
- C. Waterproof all piping and sleeves through building exterior skin, including walls, roofs and interior floor penetrations to prevent leakage. Coordinate with the Architect on caulk material to use at exterior.
- D. Size sleeves for cold piping to allow for continuous insulation through sleeve.

3.03 SEALING AND FIREPROOFING

- A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**
 - 1. Only materials tested in the specific UL System Number may be used.
 - a. Wrap Strip (UL System No. WL 5001): Nominal 1/4" thick by 2" wide intumescent elastomeric material. Manufacturer: 3M Type FS-195.
 - 1) Use one (1) wrap strip for up to one inch (1") thickness insulation.
 - 2) Use two (2) wrap strips for 1-1/2" inch and larger thickness insulation.

- b. Caulk Manufacturer:
 - 1) 3M Type CP-25 WB+ for all assemblies requiring 3M caulk.
 - 2) For WL3045 and 3046 use Hilti FS611A Sealant.
 - c. Steel Sleeve (Stud Wall) (UL System 1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum 2" lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus 1" such that, when installed, the ends of the sleeve will project approximately ½" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with pipe) to be 2 to 2-1/2" larger than the outside diameter of pipe such that, when the steel sleeve is installed, a 1 to 1-1/4" annular space will be present between the steel sleeve and the pipe around the entire circumference of the pipe. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.
 - d. Steel Sleeve (Concrete or Block Wall): For cables, provide sleeve cast in floor/wall or mortared into CMU wall; optional sleeve for UL System No. CAJ1175.
 - e. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.
2. Wire/Cables:
- a. For Gypsum Frame Wall (Single Cable): Fireproof per UL System No. WL3001. Opening for cable to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" inch larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).
 - b. For Gypsum Frame Wall (Multiple Cables): Use UL System No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.
 - c. For Concrete Walls/Floors or CMU Walls (Single or Multiple Cables): Fireproof per UL System No. CAJ3030. Cables to be a minimum ten percent (10%), maximum thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.
3. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies.
4. Materials used in firestop systems shall be installed in accordance with the manufacturer's instructions, provided with materials for specific UL System Number.

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- 5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.
- B. Manufacturers: 3M, Metacaulk, Hilti, BioFireShield, STI or equal.
- C. In non-rated walls identified for sound insulation, provide 1/2" space between pipe and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.
- D. **Final condition to prevent passage of fire, smoke, noxious gas and water.**
- E. For non-rated mechanical/electrical room walls: Seal all piping and ductwork passing through walls, floors and ceilings with 3M caulk, Type CP-25+.
- F. Submit UL numbers and details for type of penetrations and materials to be used. All penetrations in fire rated walls, floors and ceilings must be installed per a UL listed detail specified for the application.
- G. **Seal both sides of all floor penetrations into crawl space on both sides to prevent air and water migration.**

3.04 WATERPROOFING AND COUNTERFLASHING

- A. Provide and install all counterflashing of all conduit, pipe or duct and equipment which penetrates roofs, walls and other weather barrier surfaces. Metal Roofing Contractor shall provide and install all curbs and counter flashing for all metal roof penetrations. Verify detail with Architect before installation.
- B. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at contractor's expense, to Architect's satisfaction.
- C. Conduits, pipes or ducts passing through slabs shall have the sleeve extended above floors to retain any water and the space between the conduit, pipe or duct and sleeve caulked with lead wool. The top shall be sealed with lead and the bottom shall be sealed with monolastic caulking compound.
- D. All waterproofing, flashing and counterflashing shall be provided and installed by the Roofing Contractor and shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect.
- E. Slope all ducts to wall louvers to drain toward louvers. Provide continuous sleeve thru wall and seal all joints.
- F. **All piping and conduit penetrations through exterior walls shall be sealed on both side of drain plane and at exterior finished wall surface to prevent moisture intrusion.**

3.05 LABELING AND TAGGING

- A. Tag all valves with minimum 1/16" thick heat resistant laminated dark plastic labels engraved with readily legible white lettering 1/4" high indicating fluid in pipe and a "V" (valve) number (e.g. V-22). Securely fasten to the valve stem or bonnet with beaded chain. Provide an aluminum valve chart and frame with glass cover for typewritten valve chart. Install where directed. Coordinate valve numbers with mechanical contractor to avoid duplication. Refer to Section 20 00 00, and Manuals.

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- B. Label all equipment with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/2" high and fastened in place with rivets, screws or adhesive backing. Example "WH-1, AHU-1, etc." If items are not specifically listed on the schedules, consult the Architect concerning designation to use. Refer to Section 20 00 00. Label all equipment served by emergency electrical panels with red labels.
- C. Label all thermostats/sensors with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/4" high and fastened in place with rivets, screws or adhesive backing. Label is to correspond to rooftop and/or air-handling units.
- D. Provide access panel markers (minimum 1/16" thick laminated plastic type with engraved lettering) to indicate ceiling tile to be used for access for all A/C equipment, terminal units and plumbing shut-off valves. Use light green for plumbing and light blue for A/C equipment. Label to be attached to ceiling grid with rivets, screws or adhesive backing. Example, "AHU-3A" access.
- E. Manufacturer: Seton Pipe Marking Products, MSI (Marketing Services, Inc.) or equal.

3.06 TYPICAL PIPING

- A. Provide insulating couplings or unions to prevent electrolysis between dissimilar metals when use of dissimilar metals cannot be avoided in one system.
- B. Close all openings in pipes with appropriate caps, plugs, or covers during storage and progress of the work to preclude introduction of contaminants.
- C. Arrange systems and locate valves so that either entire system or separate sections thereof may be drained for service. All service valves located no more than 24 inches above the ceiling and normally accessible from an 8 foot ladder.
- D. Provide valves and unions adjacent to all tanks, batteries of plumbing fixtures and equipment, for disconnect purposes. Install all valves with stems vertical wherever possible, and in no case with stems below the horizontal.
- E. Ream ends of all pipe to full diameter.
- F. Provide pipe anchors, swing joints, and expansion compensators as required to control the expansion of pipelines.
- G. Reduce pipe sizes using reducing tees or reducing fittings. Bushings not permitted except on tanks and similar equipment.
- H. Provide escutcheons on all pipes passing through walls, floors, and ceilings in finished areas where piping is in counters, closets or cabinets, and subject to view when doors are open. Cover the pipe sleeve and secure plate in position.
- I. Install hangers at each change in direction and within 2 feet at each elbow or tee. This requirement is mandatory.
- J. Pipe hooks, wire, chains or perforated metal shall not be used for pipe supports.
- K. Insulate hangers for copper pipe from piping with at least two layers of 12 mil Polyken 826 corrosion control tape.
- L. Install piping not to interfere with removal of equipment, ducts, and devices or block access to door or access openings.

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- M. Piping serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finished wall.
- N. Test all piping in accordance with accepted trade standards if not specified elsewhere.

3.07 THREADED PIPE

- A. Cut all threads true and of depth to make up properly without leaks.
- B. Make connections to show at least two threads and not more than four threads when tight.
- C. Make up joints with Teflon tape only as recommended by tape manufacturer, or as specified in specific piping sections.

3.08 AUTOMATIC (MANUAL) AIR VENTS

- A. Install at highest point of chilled and hot water system, at chilled and hot water coils and at points necessary to relieve air in piping. Provide shut-off valve to facilitate maintenance of air vent.
- B. Route 1/4" copper line from discharge of air vent to floor drain in mechanical room. Slope to drain.

3.09 PAINTING AND CODING

- A. Ductwork and Piping: Prime and paint all exposed angle braces, hanger rods or straps, damper rods, and quadrants with one coat aluminum paint after removing scale and rust. Prime and paint ductwork and piping exposed in finished rooms to match room finish. Prime and paint all black iron piping located outdoors or otherwise exposed to weather. Coordinate painting and color with Architectural paint specified elsewhere. All painting done by persons regularly employed at and skilled in that trade.
- B. Grilles, Registers, Etc.: Furnish all grilles, registers, etc., other than extruded aluminum or plastic with prime coat paint by manufacturer. Furnish all ceiling grilles, registers and diffusers with factory applied baked enamel to match ceiling tile. Paint all ductwork and/or conduit visible through registers, grilles and other openings with one coat of flat black paint to a point four feet (4') from opening on straight duct or around bend, whichever applies.
- C. Pipe Coding:
 - 1. Identify piping with pressure-sensitive coded pipe marker at piping adjacent to equipment, at intervals along all piping not to exceed 20' and at points where piping disappears into or emerges from floors, walls or ceiling. Secure both ends of marker with pressure sensitive tape with flow arrow on roll to indicate flow direction. Color code pipe markers and arrows indicating the liquid and/or use of the pipe.
 - 2. Code piping to the following schedule: (SUBMIT ALTERNATE CODING)

Cold Water	CW
Hot Water	HW
Hot Water Circulating	HWC
Hot Water Supply	HWS
Hot Water Return	HWR
Heat Pump Supply	HPS
Heat Pump Return	HPR
Sprinkler	SPKR
Condensate	Condensate

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3. Manufacturers: Seton Pipe Marking Products, MSI or equal.

END OF SECTION

SECTION 20 07 00 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products and methods of execution which relate to the insulation of ducts, pipes and other surfaces of the mechanical installation.
2. Insulation is provided for the following purposes:
 - a. Energy conservation
 - b. Control of condensation
 - c. Safety of operating personnel

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. Acoustical Lining Insulation Summary

1. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of air duct systems of sheet metal lined with fibrous glass duct liner, in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:
2. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below and internal air temperature not exceeding 250°F (121°C).
3. Duct liner products shall conform to the requirements of ASTM C1071. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
4. The manufacturer's product identification shall appear on the air stream surface.
5. Duct liner adhesive shall conform to the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
6. The finished duct system shall meet the requirements of NFPA 90A and 90B.
7. Duct dimensions shown on the plans are finished inside dimensions.

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8. Fabrication and installation shall conform to the requirements of the latest edition of the North American Insulation Manufacturers Association's *Fibrous Glass Duct Liner Standard* (hereinafter referred to as NAIMA FGDLS) or the Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standards - Metal and Flexible* (hereinafter referred to as SMACNA HVAC DCS) or the manufacturer's recommendations.

D. References

1. American Society of Testing and Materials(ASTM)
 - a. ASTM C1071
 - b. ASTM C916
 - c. ASTM G21
 - d. ASTM G22
 - e. ASTM C423
 - f. ASTM C518
2. National Fire Protection Association (NFPA)
 - a. NFPA 90A
 - b. NFPA 90B
 - c. NFPA 259
3. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - a. HVAC Duct Construction Standards Metal and Flexible (HVAC DCS)
4. North American Insulation Manufacturers Association (NAIMA)
 - a. Fibrous Glass Duct Liner Standard (FGDLS)
5. International Nonwovens & Disposables Association (INDA)
 - a. IST 80.6

E. Delivery, Storage and Handling

1. Deliver all materials and/or fabricated, insulated duct sections and fittings to the job site and store in a safe, dry place.
2. Protect materials from dust, dirt, moisture, and physical abuse before and during installation, startup and commissioning. Wet or contaminated duct liner shall be replaced.

PART 2 - PRODUCTS

2.01 FIRE RATING OF MATERIALS

- A. Provide all insulation products used above ground in buildings with burning characteristics not to exceed the following ratings according to NFPA 255-1972 "Method of Test of Surface Burning Characteristics of Building Materials": Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.
- B. Insulation specified for use underground and above ground away from the building, might have other burning characteristics. Use such products only where specifically required.

2.02 INSULATION

- A. TYPE "A": Pre-molded Fiberglass Piping Insulation:
 - 1. Jacket Type:
 - a. Thermal conductivity $K = 0.24$ at 100° F. mean temperature.
 - b. Factory applied kraft-reinforced vapor barrier flame retardant all service jacket and tape, with permeability rating - 0.02 perms.
 - c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.
 - d. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover.
 - e. Manufacturer: Owens-Corning Fiberglass, Certainteed, Knauf, Schuller/Manville AP-TPLUS.
- B. TYPE "B": Cellular Piping Insulation:
 - 1. Thermal conductivity $K = .27$ @ 75° F. mean temperature.
 - 2. Elastomeric thermal insulation with permeability rating of .17 perms.
 - 3. Temperature range from -40° F to 220° F.
 - 4. Insulation to meet 25/50 requirements for use in return air plenums
 - 5. Wall thickness as listed in Part 3 of this Section for size and use of piping.
 - 6. Install without slit when possible. All slits in insulation to be smooth. Insulation installed with jagged edges will be removed and replaced at no cost to Owner.
 - 7. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
 - 8. Manufacturers: Armacell Armaflex Type AP Pipe Insulation, Rubatex, Halstead, IMCOA.

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C. TYPE "C": Blanket Type Duct Wrap Fiberglass Insulation:

1. **The Contractor may use a 3/4, 1 or 1-1/2 pound density product with a minimum installed R-value of 6.0 if ductwork is within building insulation envelope or minimum R-value of 8.0 if installed outside of building insulation envelope.** Density, thickness and installed R-value to be clearly indicated on submittal.
2. Fiberglass duct wrap insulation is to have a factory FSK or FRK facing which acts as the vapor barrier. Maximum permeability rating is 0.02 perms.
3. Use only labeled Type UL181AP Aluminum Foil Tape a minimum of 3" wide and 7.4 mils thick "Venture Tape #1525CW" or "Shurtape #AF-982"). Maintain a complete vapor barrier throughout all ductwork insulation applications. Use spreader to completely seal tape to all joints or tears in vapor barrier, surface must be clean prior to installation.
4. Certainteed SoftTouch Duct Wrap with FSK facing or equal. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
5. Manufacturers: Knauf, Schuller/Manville, Certainteed or Owens-Corning.

D. TYPE "D": Rigid Fiberglass Board Insulation (DUCTBOARD SYSTEM)

1. **1-1/2" thick, Type 475 with a minimum R-value of 6.0 when inside building insulation envelope.**
2. **2" thick, Type 800 with a minimum R-value of 8.0 when outside building insulation envelope.**
3. Rigid board composed of resin bonded glass fibers faced with reinforced foil vapor barrier with permeability rating of .02 perms.
4. Meet UL181 test and classified as Class I Air Duct. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
5. Maximum operating temperature of 250° F.
6. Tape joints using heavy duty foil tape, UL181A labeled, 7.5 mils thick, 3 inches wide, FSK Facing Tape Venture or equal.
7. Manufacturers: Certainteed, Knauf, Schuller/Manville, Owens-Corning.

E. TYPE "E": Semi-rigid Fiberglass Insulation Board.

1. Semi-rigid glass fiber bonded insulation not affected by moisture, resistant to fungi and bacteria. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
2. Permit expansion and contraction of metal without cracking or shrinking.
3. Maximum operation temperatures of 850° F.
4. Manufacturers: Certainteed 850 Fiberglass Insulation, Knauf, Schuller/Manville, Owens-Corning.

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2.03 SOUND CONTROL

A. Lined Duct:

1. **Provide acoustically lined duct to attenuate and control the transfer of airborne sound and as duct insulation only when specifically indicated.**
2. Lining: Flexible fiberglass blanket type mat faced insulation with durable surface coating, bonded with thermosetting resin. Maximum flame spread index; 25. Maximum smoke developed index; 50. **Lining to have anti-microbial coating.** Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0. **1.5" thick, R-6 lining equal to CertainTeed ToughGard R-EP or ToughGard2 Textile Duct Liner.** R-8 for ducts located outside the building insulation envelope. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
3. Air Friction Correction Factor 1.12 at 500 fpm or less.
4. Minimum sound absorption co-efficients as follows:

Thickness	Frequency					
	125	250	500	1000	2000	4000
1-1/2"	.17	.53	.87	.99	1.00	.95
5. All duct dimensions shown on drawings are net clear inside dimensions with duct liner. Install liner in compliance with requirements of NFPA 90A.
6. Manufacturers: Shuller, CertainTeed, Knauf or Owens-Corning.
7. All duct liner to be provided with tough abrasion resistant interior air side finish and antimicrobial coating.

2.04 INSULATED FITTING COVERS AND JACKETING

- A. High-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.
- B. Pre-cut curled jacketing, 30 mil. thickness. Sized to snugly fit pipe diameter with thickness of insulation specified.
- C. Joints and seams sealed with Perma-Weld Adhesive to form a complete vapor barrier for chilled water and domestic cold water systems. Use tack and tape for heating water and domestic hot water systems. Installation of adhesives, tacks and tape shall be per manufacturer's recommendations. Submit installation instructions with submittal of materials.
- D. Fitting Covers: Covers shall be pre-formed for fitting shape.
- E. Manufacturer: Schuller/Manville Zeston 2000, Owens-Corning Fiberglass, CertainTeed, Knauf or Proto.

2.05 CANVAS JACKETING

- A. Insulating Lagging Canvas: 8oz./sq. ft. minimum, 28 threads per inch minimum, Osnaberg or equal.

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- B. Lagging Adhesive: Plastic synthetic resin emulsion adhesive; watertight, mildew resistant, fire retardant; Miracle LA69, Borden Aerosol or equal. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

2.06 METAL OR VINALUM JACKETING

- A. Material shall be minimum .016" thick aluminum jacket or vinalum .020" thick aluminum faced PVC jacket with integral factory applied vapor barrier.
- B. Elbows, fitting and valves shall be metal preformed fitting covers (no gores acceptable). Valves made from .020 metal. All valves ends and where insulation reduces shall have Pittsburgh seams.
 - 1. All straight line metal to be Z-locked jacket held in place with 3/4" wide aluminum bands at nine inches (9") on center with wing seals.
- C. All joints and seams shall be watertight with Childers CP-76 OR Foster 95-44.
- D. Manufacturer: "Strap-On" Childer Cawed Systems or equal.

2.07 COATINGS

- A. All coating to bear the UL label. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- B. On cold or dual service lines, use vapor barrier type coatings.

2.08 METAL SHIELDS (SADDLES)

- A. Metal Shields curved to fit up to midpoint of the insulated pipe.
- B. Metal shields shall be 16 gauge, twelve inches (12") long for pipes up to two inches (2") and 14 gauge, sixteen inches (16") long for piping 2-1/2" and larger.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION AND WORKING CONDITIONS

- A. Apply all insulation, fitting covers, mastics and sealants per manufacturer's recommendations.
- B. Do not apply insulation materials until all surfaces to be covered are clean and dry and all foreign materials such as rust, dirt, etc., are removed.
- C. Keep insulation clean and dry during installation and during the application of any finish.
- D. Do not install the insulation on pipe fittings, and pipe joints until the piping is tested and approved.
- E. Do not apply under conditions of excessive humidity or at temperatures below 50° F or above 100° F.

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3.02 TECHNIQUE FOR APPLICATION TO PIPES

- A. Close longitudinal joints of pipe insulation firmly and butt insulation sections firmly together.
- B. Neatly and smoothly adhere all laps and butt strips. Adhere three inch (3") wide self-sealing butt joint strips over end joints.
- C. Replace all insulation having loose joints or laps. Sloppy work will not be acceptable and such work shall be removed and re-applied.
- D. Provide ½" over the thickness of insulation specified at all insulated piping in outside walls.
- E. Where insulation with a vapor barrier terminates, it shall be sealed with "Ductmate Protack". Ends shall not be left raw.
- F. On water piping use sheet metal shields outside the insulation at hanger locations. In addition, provide:
 - 1. A molded vegetable cork or foam glass insert not less than twelve inches (12") long of same thickness and contour as insulation between support shield and piping and under the finish jacket.
 - 2. Heavy density insulation minimum six (6) pounds per cubic foot under entire length of metal shield.
- G. Where piping and fittings are installed out of doors, provide [two-layer glass cloth and four-layer weatherproof vapor barrier adhesive coating, in addition to jacket specified] vapor barrier jacket, cover with metal or vinalum jacket with seams located on bottom side of horizontal piping.

3.03 TECHNIQUE FOR APPLICATION TO PIPE FITTINGS, UNIONS AND VALVES

- A. On insulated piping with vapor barrier, insulate fittings, unions, valves and flanges including Victaulic and Gustin-Bacon to the same thickness as the pipe insulation.
- B. Any of the following methods of insulation is acceptable:
 - 1. PVC Snap Form Fitting Covers: Wrap all valves and fittings with precut fiberglass insulation wraparound inserts. Brush vapor barrier mastic on adjoining section of pipe insulation and on overlapping edges of jacket and throat seam before applying preformed fitting. Secure cover with stainless steel tacks. Tape joints with pressure sensitive vapor barrier tape.

3.04 TECHNIQUE FOR APPLICATION TO DUCTWORK

- A. Impaling Over Pins: Install all insulation with edges tightly butted. Impale insulation on pins welded to the duct and secure with speed clips. Trim off pins close to speed clip. Space pins as required to hold insulation firmly against duct surface, but not less than one pin per square foot. Seal all joints and speed clips with glass fabric set in adhesive. Provide metal angle at corners to protect edges of insulation.
- B. Other Method of Securement: If the welded pin method is impossible, secure the insulation to the duct with "Ductmate Protack" or Childers CP-127 or Foster 85-60 adhesive. Cover the entire surface of the metal with adhesive when applying to the underside of horizontal ducts. Application to top and sides may be in strips with a minimum of 50% coverage. Additionally, secure insulation with No. 16 galvanized wire on not more than twelve inch (12") centers.

RESTROOM BUILDING

Provide metal angle at corners to protect edges of insulation. Seal joints as above. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

- C. Where external insulations terminate, seal insulation to ductwork with Childers CP-35 or Foster 30-65 with 3" glass fiber reinforcing mesh.
- D. Impale rigid insulation board over pins. Provide two layers of glass cloth and four layers of weatherproof vapor barrier adhesive coating. Install .040 thick lock-formable aluminum jacket over sealed insulation. All joints are to be 1" standing seams. The top of the aluminum jacket is to slope a minimum of 1" in 12" to sides to prevent collection of water. Install tapered insulation under sloped top for support of aluminum jacket. Provide a minimum of 1" flange out at connection point to mechanical equipment and building to ensure that water does not get under jacket. Provide counterflashing that is appropriate for building material type. Coordinate with Architect to ensure a watertight connection to building.

3.05 EXAMINATION (LINED DUCTWORK)

- A. Verify that the duct liner products is installed in accordance with project drawings, duct liner operating performance parameters and limitations, and provisions of NAIMA FGDLS or SMACNA HVAC DCS or manufactures recommendations.

3.06 INSTALLATION (LINED DUCTWORK)

- A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. All joints shall be neatly butted and there shall be no interruptions or gaps. Duct liner shall be installed with the Printed air stream surface treatment exposed to the air stream.
- B. Duct liner shall be adhered to the sheet metal with 90% (minimum) coverage of adhesive complying with the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. All transverse edges that are not to receive sheet metal nosing shall be coated. Longitudinal joints shall occur at the corners of ducts. If duct size and standard duct liner product dimensions make exposed longitudinal joints necessary, such joints shall be coated with adhesive designated for duct liner application and which meets the requirements of ASTM C 916. Such joints shall be additionally secured with mechanical fasteners in accordance with NAIMA FGDLS, or SMACNA HVAC DCS as if they were transverse joints.
- D. Duct liner shall be additionally secured with mechanical fasteners complying with the requirements NAIMA FGDLS or SMACNA HVAC DCS and of the correct type for the duct liner being installed. Fasteners may be either weld-secured or impact-driven, and shall be installed perpendicular to the duct surface. Mechanical fasteners shall not compress the insulation more than 1/8" (3 mm) based on nominal insulation thickness. Fastener spacing with respect to interior duct dimensions shall be in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fastener heads or washers shall have a minimum area of 0.75 in² (484 mm²), with beveled or cupped edges to prevent their cutting into the duct liner.
- E. Where air velocities exceed 4000 fpm (20.3 m/sec), metal nosing (either channel or "zee" profile) shall be installed on upstream edges of liner duct sections.
- F. Metal nosing shall be securely installed over transverse liner edges facing the airstream at fan discharge and at any point where lined duct is preceded by unlined duct.

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- G. Duct liner in roll form shall be folded and compressed in the corners of rectangular duct sections, or shall be cut and fit to assure a lapped, compressed corner joint
- H. Duct liner in sheet form shall be cut and fit to assure tight, over-lapped corner joints. Top pieces of liner shall be supported at the edges by the side pieces
- I. Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTM C916.

3.07 FIELD QUALITY CONTROL (LINED DUCTWORK)

- A. Upon completion of installation of lined duct and before HVAC system start-up, visually inspect the ductwork and verify that duct liner has been correctly installed. Confirm that the duct system is free from construction debris.
- B. After the lined duct system is completely installed and ready for service, conduct a final inspection of the entire system. This inspection should include, at minimum, the following steps:
 - 1. Check all registers, grilles, and diffusers to ensure that they are clean and free from construction debris.
 - 2. Check all filters in accordance with their manufacturer's instructions. Use specified grade of filters at all times that system is operating.
 - 3. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork.
 - 4. Turn the HVAC system on and allow it to run until steady state operation is reached.
 - 5. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.
 - 6. Check to ensure that air delivery performance meets all requirements and complies with SMACNA leakage specifications.

3.08 PROTECTION (LINED DUCTWORK)

- A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.
- B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.09 COLD PIPING INSULATION

- A. Insulate piping for domestic cold water, using one inch (1") Type "A" or Type "B" Insulation.

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- B. Provide a complete vapor barrier throughout the entire system. Use only vapor barrier adhesives and coatings. Stapling of jacket not permitted. Penetrations in vapor barrier jacket, joints, and seams sealed vapor proof with Childers CP-35 or Foster 30-65 (white) mastic. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. Cover ends of insulation sections with an adhesive coating at intervals of not more than twenty feet (20'). Insulate accessories, valves, flanges, etc.
- D. Cover insulation on fittings with spiral-wrapped glass mesh tape. Finish with a vapor barrier coating applied approximately 1/16" thick.
- E. Insulate all horizontal runs at primary and overflow roof drain rain leader piping from bottom of roof deck to include roof drain body, to one foot (1') past turn down fitting in vertical direction. Vertical rain leaders need not be insulated when concealed, routed inside wall cavity.
- F. Insulate all cold water piping above ceiling to point where piping turns down into chase. When piping turns down into exterior walls, piping in exterior walls must be insulated.

3.10 HOT & TEMPERED PIPING INSULATION

- A. Insulate domestic hot and tempered water and circulating lines using one inch (1") Type "A" insulation one inch (1") thickness for ½" to one inch (1") piping, 1-1/2" thickness for 1-1/4" to two inch (2") piping and two inch (2") thickness for 2-1/2" to six inch (6") piping. Domestic hot water lines may be insulated with one inch (1") Type "B" insulation.
- B. Staples may be used to seal jacket.
- C. Insulate unions, valves and flanges in boiler room only for piping over 140° F. Insulate with same method used for cold pipe fittings, except vapor barrier mastic is not required.
- D. Do not insulate valves, flanges, and unions for domestic hot water piping systems below 140° F., but bevel and seal ends of insulation at such locations.
- E. Insulate hot water expansion tank and air separators with one inch (1") sheet type "B" insulation.

3.11 SPECIAL PIPING INSULATION REQUIREMENTS

- A. Insulate buried domestic hot and cold water lines under building with one inch (1") Type "B" Insulation. Bond joints using an adhesive; apply surface treatment as recommended by insulation manufacturer, taping not permitted. Set in sand bed and cover with minimum five inches (5") sand. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- B. **Insulate all refrigerant piping for heat pump systems and suction lines only for all other systems with Type "B" Insulation:** ½" thickness for piping up to 1" and 3/4" thickness for piping larger than one inch (1"), apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 Adhesive BLV LOW VOC. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. No tape is allowed. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).

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- D. Insulate p-trap of all floor drains above the first floor and deep seal traps that receive condensate. Insulate with 3/4" thick Type "B" Insulation.

3.12 DUCT INSULATION REQUIREMENTS

A. Insulate Ducts as Follows:

1. Thickness and Type:

- a. Exhaust Air and Outside Air Exhaust Ducts: Externally wrap with Type "C" Insulation; insulate from roof deck/wall exterior back three feet (3') into space. (R-6)
- b. Supply Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- c. Return Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building envelope.
- d. Outside Air: Supply ducts externally wrapped with Type "C" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- e. Relief Air: Externally wrap with Type "C" insulation when run through unconditioned spaces, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- f. Air Devices: Externally wrap backs of all supply, return and exhaust air devices including square to round adapters and boots with Type "C" Insulation. Properly seal all edges. Use R-8 insulation for air devices with backs outside of building insulation envelope and R-6 insulation when backs of air devices are located inside building insulation envelope.
- g. Kitchen Supply: Type "C" or Type "D" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- h. Exterior Ductwork: R-8 Type "E" and/or duct liner insulation.
- i. Special circumstance as noted: R-6 or R-8 Type "G" duct liner insulation.

3.13 CONDENSATE PIPING INSULATION

- A. Condensate piping to be insulated with Type "B" Insulation 1/2" thick. Entire condensate system to be insulated when copper pipe is used.
 - 1. Apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 BLV LOW VOC Adhesive. No tape will be allowed. Auxiliary condensate not required to be insulated. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

END OF SECTION

**SECTION 22 01 00 - INSIDE UTILITY TRENCH EXCAVATION,
BACKFILL AND COMPACTION**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes general requirements, products, and methods of execution relating to excavation, backfill and compaction of inside trenches for mechanical work. Inside trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.
- B. Scope: Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawings. Excavate and backfill utility trenches. Place and compact bedding material. Compact backfill material.
- C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

- A. Local Codes and Ordinances
- B. Texas Safety Standards
- C. OSHA - Section 1926.650

1.03 SAFETY PRECAUTIONS AND PROGRAMS

- A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

PART 2 - BEDDING MATERIAL

2.01 BEDDING MATERIAL

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use clean sand. Maintain moisture content within a range that will allow specified compaction.

RESTROOM BUILDING

2.02 TRENCH BACKFILL

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material compatible with structural backfill is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size four inches (4").

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Place all excavated material suitable for backfill in an orderly manner, and in conformance with safety codes.
- B. Dispose of all material not suitable for backfilling.
- C. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris and rock, and compact to proper grade before installing piping.
- D. Follow manufacturer's recommendations for minimum trench width, material type and cover requirements.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on the drawings.
- B. Construct trench with adequate width to allow compaction equipment to be used at the sides of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DEWATERING

- A. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

- A. Do not backfill until underground mechanical system has been properly tested, inspected and approved.
- B. Coordinate with the work of others, and complete all trench work in a timely manner.

3.05 BEDDING

- A. Place bedding material under, around, and over the pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.

RESTROOM BUILDING

- C. Cover pipe with bedding material to building subgrade or to a minimum 12" depth before adding other backfill.

3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to building subgrade, or as shown on the drawings.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact all backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Architect.
- C. Compact other areas to preclude future settlement, or at least 85% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface to grade.
- B. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.

3.09 SPECIAL PRECAUTIONS

- A. Avoid unauthorized and unnecessary excavations.
- B. Minimize number and size of excavations under footings or bearing walls.
- C. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible chance of damage, and keep such precautions in place to eliminate possible damage.
- D. Backfill under footings and bearing walls, using maximum compaction or concrete of proportions as specified for footings.
- E. Avoid damage to all existing underground services, foundations, cables, conduit lines or foundations. Repair any existing underground work accidentally damaged at no additional cost to the Owner.

3.10 UNDER EXISTING SLAB INSTALLATION

- A. When breaking out an existing floor slab, make a saw cut and remove concrete. When repouring concrete, compact the fill to the same specifications as the building fill. Re: Architectural/Structural. General Contractor to make necessary saw cuts and patching as required. **Coordinate penetrations of existing grade beams with structural engineer.**

END OF SECTION

**SECTION 22 02 00 - OUTSIDE UTILITY TRENCH EXCAVATION,
BACKFILL AND COMPACTION**

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Related Work Specified Elsewhere:
 - 1. Section 20 00 00 - General Provisions
 - 2. Section 20 01 00 - Basic Materials and Methods
 - 3. Division 2 - Site Work
- B. Description: This section described general requirements, products, and methods of execution relating to excavation, backfill, and compaction of utility trenches outside of buildings. The arbitrary line of demarcation between inside and outside of buildings occurs 5' outside the building perimeter.
- C. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.
- D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders and debris. Maximum aggregate size passing a 2" sieve opening. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material is not available from trench excavation, import it from sources approved by the Architect.

RESTROOM BUILDING

- B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size 4 inches.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavate trenches to depth and grades as shown on drawings.
- B. Place all excavated material suitable for backfill in an orderly manner and in conformance with safety codes.
- C. Dispose of all material not suitable for backfilling.
- D. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If ground surface is below specified pipe grade, fill to required depth with granular materials free from debris and rock, and compact to proper grade before installing piping.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on the drawings.
- B. Construct trench with adequate width to allow compaction equipment to be used at the side of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DE-WATERING

- A. Perform whatever work is necessary to prevent flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

- A. Do not complete backfill until utility system has been properly tested, inspected, and approved.
- B. Coordinate with the work of others and complete all trench work in a timely manner.

3.05 BEDDING

- A. Place bedding material under, around, and over pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.
- C. Cover pipe with bedding material to a minimum 6" depth before adding other backfill.
- D. Cover water line with 18" bedding material before backfilling.

RESTROOM BUILDING

3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to finished grade, or as shown on the drawing.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact backfill material to preclude future settlement or at least to 90% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface to grade.
- B. Restore all surface areas to original conditions, or improve as shown on the drawings. Replace all paving, base course, gravel surfacing, sub-base, topsoil or other existing finished surface as shown on drawings.
- C. Clean up and finish all construction areas to original condition or better.

END OF SECTION

SECTION 22 11 16 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.
- B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.
- C. **SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 CONNECTION TO UTILITY WATER SYSTEM

- A. Coordinate with site utilities to properly locate and interface with the water supply. Stub water 5'-0" outside the building and make connection to water supply. See Civil Drawing for site utility locations.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS ABOVE GROUND (INSIDE STRUCTURE)

- A. Type "K" or "L" hard drawn copper tubing, wrought solder type fittings, lead free (0.00% lead content) solder.

2.02 PIPING AND FITTINGS BELOW GROUND

- A. 2" and Smaller:
 - 1. Type "K" soft copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.
 - 2. Use heavy duty Water-Tite-Sleeve as manufactured by IPS Corporation for all piping underslab. Sleeves for 1" and under shall be 25 mil., blue for cold water and red for hot water. Sleeves for 1 1/4" to 2" shall be 6 mil., black in color.
- B. 2-1/2" and Larger:
 - 1. Type "K" hard drawn copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.
- C. No joint to be installed under building slab.

2.03 WATER METER

Reference Civil Drawings

PART 3 - EXECUTION

3.01 GENERAL METHODS

- A. Make all joints in accordance with manufacturer's recommendations. The tools used shall be the tools adapted to that specific purpose.
- B. At all fixtures, install and connect hot water on left and cold water on right, as viewed when facing the fixture.
- C. Where required for connections to fixtures, equipment items, etc., employ lengths of red brass pipe with threaded ends of copper to IPS adapters, brass couplings, etc., to the end that there shall be no ferrous pipe in any water piping system.
- D. Provide valves on each branch line at the point of connection into the supply and circulating mains serving all batteries of plumbing fixtures. Provide stop valves in each water supply for every plumbing fixture. Each hose bibb is to have an individual shut off valve, separate from valves that would shut down a battery of fixtures. Valves for piping two inches (2") and smaller shall be ball valves.
- E. Provide water hammer arrestors with accessible isolation valve equal to Wade Shok-stops, JR Smith Hydrotrol 5000 Series, or Zurn Shocktrols A-1700 Series on cold water and hot water supplies to plumbing fixtures. Provide access door for all concealed arrestors. Shok-stops shall not be installed in the pendant position. **O-ring type arrestors are not considered equivalent. Arrestors are to be installed in locations and sized per Manufacturer's installation instructions.**
- F. Install vacuum breakers on all plumbing lines where contamination of domestic water may occur and on boiler make-up lines and hose bibbs.
- G. Insulate all exposed water connections for handicapped lavatories and sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868).

3.02 TESTING

- A. Test all water piping hydrostatically at 150 psig or 150% of working pressure, whichever is greater, for a period of 24 hours. Observe piping during this period and repair all leaks. Test for lead, certify that lead residual in piping system does not exceed local code requirements.

3.03 STERILIZATION OF DOMESTIC WATER SYSTEMS

- A. Sterilize each unit of completed supply line and distribution system with chlorine solution before acceptance for domestic operation.
- B. Accomplish sterilization as described below or by the system prescribed by the American Water Works Association Standard C-601. Apply the amount of chlorine to provide a dosage of not less than 50 parts per million. Provide chlorine manufactured in conformance to the following standards:
 - 1. Liquid Chlorine: Federal Specification BB-C-120.
 - 2. Hypochlorite: Federal Specification O-C-114a, Type 11, Grade B or Federal Specification O-X-602.

RESTROOM BUILDING

- C. Introduce the chlorinating material to the water lines and distribution system after piping system has been thoroughly flushed. After a contact period of not less than 24 hours, flush the system with clean water until the residual chlorine content is not greater than .2 parts per million.
- D. Open and close all valves in the lines being sterilized several times during above chlorination.
- E. The sterilization process shall be done by persons whose major business is water treatment and sterilization. The Plumbing Contractor shall pay all costs and charges associated to this test and certification.
- F. Certify in writing that sterilization has been completed in accordance with these requirements.

END OF SECTION

SECTION 22 11 17 –WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.
- B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.
- C. **SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 – PRODUCTS

2.01 WATER HEATER

- A. Electric Water Heater:
 - 1. Pre-wired, factory tested, NSF certified and with UL seal of approval.
 - 2. Tank: Glass lined and ASME approved for 150 psi working pressure with a minimum of 2" of high density foam insulation; Anode rods for electrolytic protection and hand hole inspection port.
 - 3. Thermostats are to be of the immersion type; one thermostat per each set of 3 elements.
 - 4. The complete system to be protected by energy cut off switch in the event of an over temperature situation.
 - 5. Manufacturer: State, PVI, A.O. Smith, Rheem or approved equal.
- 2.02 Provide an ASME rated temperature and pressure relief valve with drain piping to the nearest drain receptor for all water heaters. The temperature and pressure relief valve shall be labeled and shall be tested in accordance with ANSI Z21.22.
- 2.03 Provide heat traps on incoming and discharge lines from water heaters that do not come with factory installed heat traps or are not connected to a recirculation system.

END OF SECTION

SECTION 22 13 16 - LIQUID WASTE TRANSFER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products, and methods of execution relating to the transfer of liquid waste for the project. The work of this section includes providing the following:

- a. All liquid waste piping and fittings:

- 1) Soil
 - 2) Rain leaders
 - 3) Building sewer

- b. All plumbing vents, including their termination.

- c. All connections at points of collection of handling:

- 1) At plumbing fixtures and trims
 - 2) At equipment by others.

- B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

- C. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.

IF PVC OR CPVC IS USED IN PLENUM SPACES IN LIEU OF CAST IRON, THEN PIPING MUST BE WRAPPED WITH CODE APPROVED INSULATION TO PROTECT PIPING AND MEET 25/50 REQUIREMENTS.

- D. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International as well as conform to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings, and be manufactured by Charlotte, Tyler, or AB&I .

- E. All pipe and fittings shall be manufactured in the United States.

RESTROOM BUILDING

- 1.02 CONNECTION TO UTILITY SEWER AND STORM DRAIN SYSTEMS (storm drain piping is considered to be piping beyond 5'-0" outside the building)
- A. Final wastewater connection point to extend approximately five feet (5') outside the building, as indicated on the drawings. Coordinate with Civil Drawings for wastewater service point to within five feet (5') of the building. **Coordinate with site utilities to insure proper inverts for all lines and connection point prior to installation.** Contact Architect immediately if any conflict is discovered. Make final connection to service line. Obtain all permits, pay fees and provide all services incidental to this work.

PART 2 – PRODUCTS

- 2.01 SEWER PIPE UNDERGROUND INSIDE STRUCTURE (INCLUDES TO FIVE FEET FROM BUILDING PERIMETER)
- A. Service weight cast iron soil pipe with Tyseal neoprene gaskets.
- B. Schedule 40 PVC (SOLID WALL DWV pipe and fittings) as allowed by code. Material Data: Type 1, Grade 1 PVC 12454-B, ASTM D-1784.
- C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.
- D. Waste line serving commercial dishwasher in kitchen and associated main to be service weight cast iron soil pipe with Tyseal neoprene gaskets to a point twenty feet (20') downstream of dishwasher. Remainder of grease system in kitchen may be PVC as listed in 2 above.
- 2.02 RAINLEADERS BELOW SLAB AND ABOVE GROUND INSIDE STRUCTURE
- A. Cast iron soil pipe with heavy weight no-hub fittings.
- B. **Underground RAINLEADER piping: Use stainless steel couplings (28-gauge, Type 304SS) with neoprene gasket meeting ASTM Standard C-564 meeting FM 1680, Class 1. Husky SD 4000, Clamp-All 80 lb. or equal.**
- 2.03 SEWER ABOVE GROUND INSIDE STRUCTURE
- A. Service weight cast iron soil pipe with tyseal neoprene gaskets or cast iron soil pipe with no-hub fittings. Reference 2.06 below.
- B. Schedule 40 PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**
- C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.
- 2.04 VENTS
- A. All vent piping above slab to be cast iron soil pipe with tyseal neoprene gaskets or no-hub fittings.
- B. All vent piping under slab to be heavy weight no-hub fittings.
- C. Vents 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron fittings.
- D. DWV copper with wrought or cast solder fittings.

RESTROOM BUILDING

- E. Schedule 40 PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**

2.05 CAST IRON PIPE/FITTINGS

- A. Tyseal Gaskets or MG Couplings.
- B. Hubless couplings shall be composed of a stainless steel shield, clamp assembly and an elastomeric sealing sleeve conforming to the most current edition of CISPI 310, listed by NSF International, manufactured in the United States of America, and manufactured by Anaco, Mission, Tyler or Ideal.

2.06 CONDENSATE PIPING

- A. Type L or M: Hard drawn copper.

PART 3 – EXECUTION

3.01 INSTALLATION OF UNDERGROUND PIPING

- A. Install pipe and fittings to required grade with hubs and bottom half section in undisturbed soil. Follow manufacturer's installation requirements.

3.02 INSTALLATION OF ABOVE GROUND PIPING

- A. Refer to Section 20 01 00.

3.03 GRADING

- A. Grade all horizontal runs of pipe in building and under floor slab at 1/4" per foot downward in direction of flow. If it is absolutely impossible to maintain a grade of 1/4" per foot, piping four (4) inches in diameter and larger may slope to a minimum grade of not less than 1/8" per foot.

3.04 SUPPORTING

- A. Support all horizontal runs of pipe in building at intervals not to exceed 5'-0" and at each change of direction. Provide a support at the base of vertical risers with intermediate supports as required. Brace all adequately to prevent motion, per manufacturer's recommendation. Reference Section 20 01 00, 2.08, B., Mechanical Support Devices and Pipe Supports for further requirements.

3.05 CLEANOUTS

- A. Provide cleanouts as shown on plans and in an accessible location at base of all risers in soil, waste and drain piping and at each change in direction in horizontal runs of pipe. In long straight runs, provide a cleanout located at intervals of not more than 75 feet for piping four inches (4") and larger and located at intervals of not more than 50 feet for piping less than four inches (4").
- B. Cleanouts shall be located no closer than 24" to a wall.

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3.06 VENTING

- A. Provide a vent for each trap or as shown on the drawings.
- B. Extend each vent vertically to a point not less than six inches (6") above the extreme overflow level of the fixture served before offsetting horizontally. Whenever two or more vent pipes converge, extend each such pipe at least six inches (6") in height above the flood rim level of the plumbing fixture it serves before being connected to any other vent and utilize only approved drainage fittings and materials to connect piping.
- C. Provide a building main relief vent for waste piping not provided venting by fixture branch connections. Vent size shall be per code requirement, based upon fixture unit loading in the pipe vented.

3.07 VENTS THROUGH ROOF

- A. Extend vents through the roof a minimum distance of 6" and terminate at least 15 ft. horizontally from operable windows, doors, or air intakes, and at least 3 feet above such opening. Do not terminate vents through roof at edge or valley of roof.
- B. Flash and counterflash vents through roof. Provide flashings not less than 18" square, with prefabricated 4-pound lead counterflashing. Extend vertical portion of flashing up entire length of pipe and turn down inside the pipe at least 1 inch with turned edge hammered against pipe. Coordinate with type roof and Architectural details and flash them into roof according to the roofing products manufacturer's recommendations.
- C. Protect the roof from tools and equipment. Remove all scraps on roof to prevent damage to roof.

3.08 GENERAL

- A. No piping shall be permanently concealed before the examination is completed by the authorities having jurisdiction.
- B. All fixtures used in conjunction with the conveying of waste substance shall be connected by means of a trap.
- C. All connections for floor mounted water closets and waste piping shall be made with appropriate closet flange and wax gaskets.
- D. Insulate all exposed p-traps for handicapped lavatories and handicap sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868) as required.
- E. Provide specialty shielded transition coupling as required at connections between PVC and cast iron fitting.

3.09 TESTING

- A. Test all piping in accordance with the requirements of the local codes.
- B. Repair leaks and retest system, repeating this process until piping system is free of leaks.
- C. Test shall be conducted and completed before any joints are concealed or made inaccessible.
- D. Maintain a log of tests indicating date, time, result of test and person doing test.

RESTROOM BUILDING

- E. Under floor.
 - 1. Test pipe under floors before connecting to sewers.
 - 2. Maintain not less than 15 feet of hydrostatic head.
 - 3. Repair all leaks and repeat until system holds for 2-hours without a drop in water level.

3.10 CONDENSATE PIPING

- A. Route insulated copper condensate drain line from each unit to nearest floor drain, deep seal traps, sink p-traps, janitor sink, dry well (exterior units), or roof drain if piped to storm sewer (cannot use roof drain if day lites at surface) code approved or disposal point unless otherwise noted. Condensate shall not drain on to roof. Mechanical Contractor and Plumbing Contractor to coordinate locations. Slope all piping to drain at minimum 1/8" per foot. Drains shall be sized in accordance with equipment capacities as follows:

EQUIPMENT CAPACITY	*MINIMUM PIPE SIZE
Up to 3 tons of refrigeration	3/4"
3 to 20 tons of refrigeration	1"

*Minimum size of drain shall not be smaller than drain outlet size for unit.

- B. Coordinate mounting heights of units to allow adequate slope for condensate piping to disposal point.
- C. Provide cleanout plug at end of each main run.
- D. Drywell (French Drain): The drywell shall consist of a pit not less than 24" in diameter (or 24" x 24") and 24" in depth. The pit shall be filled to within 3" of the finished grade with coarse gravel. Top 3 inches to be filled with topsoil and sodded. Gravel to be wrapped completely (top, sides and bottom) with heavy duty weed block fabric. Install a 3" perforated PVC drain pipe (centered in drywell) with cap at bottom extending to bottom of pit. 3" perforated pipe to extend 3" - 5" above finished grade. Provide appropriately sized bushing or fittings to rigidly tie to condensate drain line from unit. Perforated pipe above grade will act as air break connection. Twenty-four inch (24") diameter or 24" x 24" x 24" deep can be used for up to 5 ton capacity. Thirty-six inch (36") diameter or 36" x 36" x 24" deep can be used for up to 13 ton capacity. Forty-eight (48") inch diameter or 48" x 48" x 24" deep can be used for up to 30 ton capacity. Confirm final requirements with code authority having jurisdiction.

END OF SECTION

SECTION 22 30 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
 - 1. This section describes certain components of domestic plumbing systems, including related specific requirements, products and methods of execution. Plumbing water, waste, vent piping and other primary distribution components of the plumbing system are included with related work specified elsewhere.
- B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

- A. All floor drains, including floor sinks, are to be the same size as the waste line size indicated on plans. If size is not indicated, drain size shall be 3". Floor drains that tie in to acid waste piping are to have acid resistant coating or be stainless steel. Floor Drains and Floor Sinks in kitchen areas are to have Acid Resistant Enamel coating or be constructed from stainless steel.
- B. **PROVIDE TRAP PRIMING APPARATUS FOR EACH FLOOR DRAIN AND FLOOR SINK UNLESS NOTED OTHERWISE.** Whenever possible, use an inverted tee connection from sink tailpiece or device similar to Jay R Smith Prime-EZE for trap priming with gray water. Second choice is to use flush valve trap primer connection. As last resort, provide mechanical trap primer (Manufacturer: Precision Plumbing Products, "Oregon #1 or equal as required) connected to supply lines as small as possible, but never over 1-1/2" diameter. Provide minimum 12 x 12 access door or larger as required. When local jurisdiction (such as the City of Pflugerville, Tx.) does not approve the use of a standard mechanical trap primer (similar to Oregon #1) that activates from pressure differential and other methods are not practical, provide an electronic trap primer as last resort. Coordinate electrical requirements with electrical contractor. Proset "TRAP GUARD" device may be used in lieu of trap primers when allowed by local code authority having jurisdiction and building Owner. Before using Proset "TRAP GUARD" contractor must obtain written approval from local code authority having jurisdiction and provide copies to Architect and Engineer.
- C. Trap primers must conform to ASSE 1018 or ASSE 1044.
- D. Trap Primer Manufacturers: MIFAB, Precision Plumbing Products, Jay R Smith, Sloan, Zurn, Wade or Watts.
- E. Floor Drain/Floor Sink Manufacturers: StainlessDrains, Kessel, MIFAB, Josam, Wade, Zurn or Jay.R. Smith, Watts.

RESTROOM BUILDING

2.02 CLEANOUTS

- A. Cleanouts shall be same nominal size of pipe lines up to four inches (4") and not less than four inches (4") for larger lines.
- B. Floor Cleanouts: Gas and watertight seal, internal taper ABS cleanout plug, stainless steel or nickel bronze finish scoriated round top with countersunk screw for installation flush with finish floor. MIFAB C1100R-3 Series. If floor has a waterproof membrane then add C clamp ring flange.
- C. Wall Cleanouts: MIFAB C1400-RD Series. Countersunk plugs, with smooth round access cover and polished stainless steel or nickel bronze finish.
- D. Manufacturers: StainlessDrains, MIFAB, Josam, Zurn, Wade, Watts or approved equal.
- E. Cleanouts that tie in to acid waste piping to be acid resistant.

2.03 FIXTURES

- A. Manufacturers:
 - 1. The fixtures are chosen from standard manufacturers.
 - 2. Provide all similar fixtures and trim from one (1) manufacturer, except where specified otherwise.
 - 3. Equality: The following manufacturers are considered equal, specified item(s) sets minimum standard for acceptability.
 - a. **Fixtures:** American Standard, Crane, Eljer, Kohler, Elkay, Fiat, Sloan, Toto, Zurn, Caroma.
 - 1) All water closet bowls shall have fully glazed trap.
 - 2) All water closet bowls must meet MAP Testing (Maxim Performance Testing) at 1000 grams.
 - b. **Faucets:** American Standard, Bradley, Elkay, Chicago, Sloan, Zurn, T & S Brass, Moen Commercial.
 - c. **Stainless Steel Sinks:** Elkay, Bradley, Moen or Just.
 - d. **Carriers:** MIFAB, J.R. Smith, Josam, Watts or Zurn.
 - e. **Flush Valves:** Sloan Royal or equal by Zurn
 - f. **Point of Use ASSE 1070 Lead Free Mixing Valves:** Watts, Powers, Bradley, Leonard, Lawler, Symmons or Moen.
 - g. **Drinking Fountains/Electric Water Coolers:** Elkay, Acorn Aqua Surf, Oasis or Halsey Taylor, must meet NSF Section 9 in its entirety and meet TCEQ Certification Requirements. Provide letter with submittal data.
 - h. **Wash Fountains:** Bradley, Wiloughby or Sloan Stone.

RESTROOM BUILDING

- i. **Wall Pipe Supports:** HoldRite or Equal
 - j. **Circulating Pumps:** TACO, Grundfos, Armstrong, Wilo
 - k. **Stainless Steel Skullery Sinks:** Elkay, Bradley, Just, Advance Tabco, Griffin.
 - l. Provide wall carriers for ALL wall-mounted fixtures, including wash fountains.
- B. Traps, Stops and Supplies:
 - 1. Provide traps, stops and supplies for all fixtures.
 - 2. P-Traps: 17 gauge chrome-plated cast brass.
 - 3. Supplies: Flexible, chrome-plated, 7538 Series.
 - 4. Stops: Removable key type, 2302 Series.
 - 5. Supplies and stops are to meet current requirements of NSF61.
 - 6. Manufacturers: American Standard, Brass Craft, McGuire or equal.
- C. Fixtures Specified Elsewhere, or Otherwise Furnished. Provide appropriate strainer, tailpiece, trap, waste and supplies. Rough-in and connect only.
- D. Faucets:
 - 1. All faucets except commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed by NSF as residential drinking water faucets.
 - 2. All faucets not NSF 61 listed, (as described in paragraph 1) must have tin lined waterways or other such material so water flowing through the faucet is not in contact with any material that could allow "Leaching" of lead into the waterway.
 - 3. Commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed as commercial faucets. Faucets meeting the stricter residential standards can be used at contractor's option.
 - 4. Faucets are not allowed to have more than the maximum total lead content as listed by NSF, TCEQ (Health and Safety Code) and EPA.
 - 5. Any faucets which exceed lead concentration "Leaching" into water stream after a minimum of 45 days usage and proper flushing prior to testing shall be replaced by the manufacturer with an acceptable product. All costs of change out incurred will be sole responsibility of the manufacturer.
 - 6. Lavatory faucets to have .5 GPM vandal resistant aerator.
- E. Waterways and tanks for all drinking fountains and water coolers shall be constructed of 3. lead-free (0.00% lead) materials. All waterways to be totally free of lead. No lead solder is permitted. All drinking fountains and water coolers to meet latest criteria of TCEQ, EPA and be listed by NSF.

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- F. All water line, fittings and fixtures in contact with potable water to be "lead free" AB1953 compliant. (.25% or less average lead content). All submittals to state items comply in submittal package.

2.04 FIXTURE FLOW RATES

- A. The maximum flow rates for plumbing fixtures are to be no greater than quantities listed below:
 - 1. Toilets – 1.28 gallons per flush GPF) on all projects .
 - 2. Urinals – 0.125 gallons per flush (GPF) on all projects
 - 3. Lavatory (hand sink) – 0.5 gallons per minute (GPM) on all projects
 - 4. Shower – 2.0 gallons per minute (GPM) on all projects

PART 3 - EXECUTION

- 3.01 Store all fixtures and trim above ground in a covered location not subject to accidental damage by traffic or other construction activities. Handle fixtures and trim carefully to avoid chipping, denting, scratching, or other damage. Replace damaged items with same item in new condition.
- 3.02 Provide permanent metal and wire positioners, supports and fixture carriers to secure fixtures and piping rigidly in proper alignment without sway or side play.
- 3.03 Anchor all fixtures securely to withstand applied vertical load of not less than 250 pounds on the front of the fixture, without noticeable movement.
- 3.04 Install all fixtures plumb, level and flush to the finished Architectural surface, so that the maximum gap between the fixture and the surface does not exceed 3/16 inch. **Grout** under water closets to level fixtures. Caulk the edge of the joint between fixture and surface with silicone or butyl type waterproof caulking compound.
- 3.05 Adjust all functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.
- 3.06 Clean all fixtures and trim thoroughly to spotlessly clean condition. Obtain a written certification from the Architect that this has been accomplished.
- 3.07 Where floor drains or janitor sinks are located over any room, provide waterproof installation.
- 3.08 Ensure final location of cleanouts have access and ample clearance at cleanout for rodding of drainage system. Check locations before installation. Contact Architect for alternate location if maintenance clearance is a problem. Cleanouts to be moved at no additional cost to Owner for failure to coordinate locations.
- 3.09 Coordinate slope of floors to floor drains with Architect. Adjust height of floor drain for proper drainage.
- 3.10 Provide all adapters, flanges, gaskets, etc. as required for proper installation of fixtures. Coordinate fixture placement before core drilling of floor or sleeve installation.

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- 3.11 Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).
- 3.12 **No offset flanges will be allowed for installation of water closets.**
- 3.13 Install all trap priming devices per manufacturer's installation instructions. Provide shut-off valves at each mechanical or electronic trap primer for service. Install minimum 12" x 12" access doors as required for service of trap priming devices.
- 3.14 Provide a floor sink with trap priming device in each sprinkler riser room.
- 3.15 Cleanout locations:**
- A. On each horizontal drain line 5 feet or greater in length.**
 - B. No more than 50 feet on center.**
 - C. At changes in direction of 90 degrees or more (line size).**
 - D. At the end of each continuous waste line.**
 - E. At the end of each battery of fixtures.**
 - F. At each sink and urinal.**
 - G. Additional areas required for service and by code.**

END OF SECTION

SECTION 23 08 02 - CONTRACTOR START-UP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. **This section describes specific requirements and methods of execution which relate to the Contractor start-up of the mechanical installation by the mechanical contractor and their subcontractor's, acting together as a team. The contractor, all their subs and vendors (as required) will spend sufficient time TOGETHER at the site to insure that all requirements are met.**
2. Contractor start-up is a performance verification and documentation process of ensuring that all mechanical systems are installed and are performing according to the design intent and operational needs of the project. The Contractor start-up process encompasses a coordinated effort for system documentation, equipment startup, control system calibration, testing and balancing, and performance testing and training.
3. Contractor start-up by the contractor during the construction phase is intended to achieve the following specific objectives;
 - a. Verify that applicable equipment, controls and systems are installed according to the plans and specifications, manufacturer's recommendations and to industry accepted minimum standards.
 - b. **Verify and document proper performance of equipment and systems as a whole and as controlled by the DDC system. Verify that total integration of the mechanical and DDC systems are complete and fully operational in all modes. This requires both the mechanical contractor and the control contractor to work together at the site at the same time as required. Testing equipment operation with jumper wires or in a stand alone mode and/or testing controls for continuity does not meet the requirements of this section.**
 - c. Verify that the Owner's operating personnel are adequately trained.
 - d. Verify balancing report is completed and outside ventilation air quantities are confirmed.
4. **RETAINAGE WILL NOT BE RELEASED UNTIL WORK OF THIS SECTION IS SUCCESSFULLY COMPLETED. IF THE CONTRACTOR CAN'T COMPLETE THIS WORK IN A TIMELY FASHION IT WILL BE ASSIGNED TO A THIRD PARTY FOR COMPLETION AND BILLED AGAINST THE CONTRACTORS' RETAINAGE.**

- B. SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and checkout and functional performance testing shall be provided by the contractor for the equipment being tested.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according the Contract Documents shall be included in the base bid price to the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5° F and a resolution of + or - 0.1° F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

- A. Pre-Contractor start-up Meeting: At the beginning of the project the contractor shall schedule, plan and conduct a pre-Contractor start-up meeting with the district, engineer and construction manager to discuss process and procedures to be used in contractor Contractor start-up process.
- B. Miscellaneous Meetings: Other meetings will be held throughout project at owner, engineer or contractor request during construction, to cover Contractor start-up progress coordination, deficiencies, and other Contractor start-up issues.

3.02 EQUIPMENT REQUIRING MANUFACTURER START-UP:

- A. Standard manufacturer start-up forms shall be submitted for review.
- B. HCE forms must be fully completed and included in the Contractor start-up report.
- C. All standard forms shall be signed and dated by technician doing start-up and shall be included in final Contractor start-up report.

3.03 TESTING CRITERIA:

- A. **Systems shall be tested in all modes of operation (ie. cooling/heating, dehumidification, occupied/unoccupied modes, etc.). Systems may be started up in a stand alone mode before control integration is complete, however all HVAC systems must be totally rechecked in all modes of operation through the manipulation of the DDC system once that part of the work is complete. Using jumper wires and testing for continuity does not meet the testing requirements.**
- B. **Tests are to be performed under conditions that simulate actual conditions where possible. Simulated test conditions are allowed in order to confirm system functions at required conditions. At completion of individual tests, all affected building equipment and setpoints shall be returned to their pre-test condition.**

- C. **Simply filling out the associated Contractor start-up Form does not totally satisfy all requirements of this section. Perform all testing as outlined in this section. Provide signed and dated documentation of all testing. Legible field notes that are signed and dated are acceptable.**

3.04 CONTROLS:

- A. A sequence shall be submitted that gives a clear concise narrative of the functional operation for each different system. This should be coordinated with control submittal.
- B. Confirm as a minimum, the following for each space sensor (temperature, humidity, CO₂):
1. Verify that sensor is labeled to match associated equipment number.
 2. Verify that foam isolation pad is installed behind sensor.
 3. Verify sensor location is appropriate and not in direct airflow from adjacent grille or sunlight.
 4. Verify that sensor element is not in contact with cover, base or set point adjustment.
 5. Test sensor with separate meter adjacent to (with-in 4 inches) sensor and verify building automation system (BAS) readout is with-in tolerance. Adjust offset as required for proper calibration. Recheck sensor. Insure measuring instrument is allowed to settle out at each sensor prior to confirming reading. Temperature tolerance is +/- 0.5°F, humidistat tolerance is +/- 3%.
 6. Replace any bad sensors, and document which sensor is replaced.
 7. Confirm that push button override is set for 120 minutes.
 8. Confirm that push button override is operational.
 9. Confirm that set point adjustment at thermostat is set for +/- 3°F.
 10. Confirm occupied heating, cooling and RH set points.
 11. Confirm occupancy schedules. (May turn over to Owner with floor level schedule set at 7am to 4pm with no imbedded schedules at equipment level at owner's request.)
 12. Confirm fan status (continuous or automatic mode).
 13. Confirm that zone sensors are properly located, labeled and that they actually control the equipment that serves that zone.
 14. **Physically confirm that the HVAC equipment performs all of the functions that the controls can command it to do, in all modes. Continuity check alone is NOT SUFFICIENT.**
 15. **CONFIRM THAT ANY INTEGRAL UNIT MOUNTED CONTROL SETTINGS HAVE BEEN PROPERLY SET UP TO MATCH THE JOB REQUIREMENTS AND TO PROPERLY INTEGRATE WITH THE DDC SYSTEM AS INSTALLED.**
- C. Document all test data for sensors, etc, on appropriate control system Contractor start-up Forms.

RESTROOM BUILDING

3.05 ROOF TOP UNITS / SPLIT SYSTEMS:

- A. Submit any required manufacturer's start-up test report.
- B. In addition to any start-up reports perform checkout and record the following for each piece of equipment.
 - 1. Unit size and model number.
 - 2. Outside air (O/A) temperature and humidity during testing period.
 - 3. Verify interior of unit is clean.
 - 4. Insure O/A damper has been adjusted and balanced, permanently mark position of damper.
 - 5. Verify that fan rotation is correct.
 - 6. Verify that cooling coil is clean.
 - 7. Verify that condenser coil is clean and fins are not damaged.
 - 8. Verify that hail guards are installed if specified.
 - 9. Confirm that condensate drain and trap are installed properly and drain pan is clean.
 - 10. Verify that overflow switch is installed and working properly for AHU's.
 - 11. Verify that heating and cooling modes are functioning and record inlet and discharge air temperatures in each mode.
 - 12. Verify that filters are clean.
 - 13. Confirm that belt tension and alignment has been adjusted properly.
- C. Document all Contractor start-up data on Form C2.0 for Roof Top Units and on Form C3.0 for Split System Units.

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS				
FORM C1.0		Page 1 of 2		
(CONTROLS CONTRACTOR)				
PROJECT NAME: _____		PAGE: ____ OF ____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
1	TEMP. SENSOR LABELED			
2	HUMIDITY SENSOR LABELED			
3	CO2 SENSOR LABELED			
4	FOAM ISOLATION PAD INSTALLED BEHIND SENSOR			
5	VERIFY TEMPERATURE / HUMIDITY / CO2 SENSOR LOCATION (LIST ROOM #)			
6	LIST OFFSETS INPUT TO CALIBRATE TEMPERATURE / HUMIDITY / CO2			
7	SENSOR PUSH BUTTON OVERRIDE SET FOR 120 MINUTES & FUNCTIONAL			
8	SET POINT ADJUSTMENT AT SENSOR +/- 3 DEGREES			
9	OCCUPIED COOLING SET POINT			
10	OCCUPIED HEATING SET POINT			
11	UNOCCUPIED COOLING SET POINT			
12	UNOCCUPIED HEATING SET POINT			
13	OCCUPANCY SCHEDULE			
14	HUMIDITY SET POINT (%RH)			
15	FAN STATUS ON SS/RTU A = AUTO C = CONTINUOUS			

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS				
FORM C1.0		Page 2 of 2		
(CONTROLS CONTRACTOR)				
PROJECT NAME: _____		PAGE: ____ OF ____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
16	PHYSICALLY CHECK & VERIFY THAT CONTROL SIGNAL(S) ACTUALLY INITIATES ALL MODES OF UNIT FUNCTION REQUIRED FOR THE TYPE HVAC EQUIPMENT BEING CONTROLLED.			
17	VERIFY THAT UNITS INTERNAL CONTROL SET POINTS (ECTO SETTINGS ON LENNOX RTU'S FOR EXAMPLE) HAVE BEEN SET TO MATCH THE REQUIREMENT FOR THE EXTERNAL CONTROLS ACTUALLY INSTALLED.			
18	LIST EQUIPMENT TYPE, IE, E/E SS, HP SS, GAS HEAT RTU, E.E RTU ETC...			
19	LIST COOLING STAGES			
20	LIST HEATING STAGES			
21	IF HEAT PUMP, DOES EM. HEAT COME ON DURING DEFROST CYCLE?			
22	IF HORIZONTAL SPLIT SYSTEM, IS FLOAT SWITCH WIRED INTO CONTROLS?			
23	VERIFY THAT OWNER HAS RECEIVED SPECIFIED AMOUNT OF OWNER TRAINING.			
24	VERIFY THAT SITE COMPUTER HAS BEEN INSTALLED WITH ALL REQUIRED PROGRAMMING, GRAPHICS & BACKUP CD OF SITE SPECIFIC PROGRAMMING.			
ok = ITEM VERIFIED AND ACCEPTABLE				
X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION				
n/a = DOES NOT APPLY				
REMARKS:		POINT TO POINT CHECK OUT OF CONTROLS DOES NOT CONSTITUTE THE FUNCTIONAL CHECK OUT REQUIRED.		

SPLIT SYSTEM CONTRACTOR START-UP				
FORM C3.0		PAGE 1 OF 2		
(MECHANICAL CONTRACTOR)				
PROJECT NAME: _____		PAGE: _____ OF _____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
1	UNIT SIZE / TYPE			
2	AHU MODEL NUMBER			
3	CU/HP MODEL NUMBER			
4	INDOOR TEMPERATURE (AND RH IF AVAILABLE)			
5	OUTSIDE TEMPERATURE / HUMIDITY			
6	CONDITION OF UNIT INTERIOR C = CLEAN NC = NEEDS CLEANING			
7	OUTSIDE AIR DAMPER ADJUSTED AND MARKED			
8	OUTSIDE AIR CONNECTED PER PLANS			
9	CHECK FAN ROTATION			
10	CONDITION OF INDOOR COIL C = CLEAN NC = NEEDS CLEANING			
11	CONDITION OF COND. COIL C = CLEAN NC = NEEDS CLEANING			
12	CU / HP SECURED TO ROOF SUPPORT			
13	DRAIN PAN CLEAN			

SPLIT SYSTEM CONTRACTOR START-UP				
FORM C3.O				PAGE 2 OF 2
PROJECT NAME: _____				PAGE: _____ OF _____
INDIVIDUAL PERFORMING TEST: _____				DATE: _____
#	DESCRIPTION	UNIT MARK		
14	CONDENSATE DRAIN AND TRAP INSTALLED PROPERLY			
15	COOLING DISCHARGE AIR TEMP. IF MULTISTAGE, ARE ALL STAGES OF COOLING OPERATIONAL?			
16	HEATING MODE DISCHARGE AIR TEMPERATURE			
17	IF HP, DOES EM HEAT COME ON IN DEFROST CYCLE?			
18	HOT GAS REHEAT DISCHARGE AIR TEMPERATURE			
19	CONDITON OF FILTERS C =CLEAN D = DIRTY			
20	BELT TENSION AND ALIGNMENT PROPERLY ADJUSTED			
21	ATTACH START-UP FORM WITH REFRIGERANT PRESSURES, AMPS, ETC.			
ok = ITEM VERIFIED AND ACCEPTAB				
X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION				
n/a = DOES NOT APPLY				
REMARKS:		ALL OPERATIONAL MODES ARE TO BE CHECKED BY MANIPULATING CONTROLS THAT THE OWNER WILL END UP WITH. USE OF JUMPER WIRES OR PLACING UNIT CONTROLLER IN STAND ALONE MODE IS NOT ACCEPTABLE FOR CONTRACTOR START-UP.		

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Description: This section describes specific requirements, products and methods of execution relating to the project air distribution systems.
- B. Provide all air distribution systems as shown and specified, complete in every detail and in perfect operating order.
- C. All equipment warranties to be per Specification Section 20 00 00, 1.17.
- D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 Provide all air distribution work in accordance with the minimum provisions of the latest approved editions of the following codes and standards.

- A. NFPA 90 A - Air Conditioning and Ventilating Systems.
- B. NFPA 90 B - Warm Air Heating and Air Conditioning.
- C. SMACNA - Low Velocity Duct Construction Standards.
- D. TIMA - Fibrous Glass Duct Construction Standards.
- E. SMACNA - Duct Liner Application Standard.
- F. SMACNA - Ducted Electric Heat Guide.
- G. AMCA Standard 210-74 Laboratory Methods of Testing Fans for Rating Purposes.
- H. AMCA Pub. 261 Directory or Products Licensed to Bear the AMCA Certified Rating Seal.
- I. AMCA Standard 300-67 Test Code for Sound Rating.
- J. AMCA Standard 301-65 Method of Publishing Sound Ratings for Air Moving Devices.
- K. AMCA Publication 511-75 Certified Ratings Program for Louvers, Dampers and Shutters.
- L. ASHRAE Standard 52-76 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- M. ASHRAE Standard 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

1.03 Where any references to "sheetmetal work" or "ductwork" appears in this section of these specifications or on the drawings, it shall be construed to include outside air ducts, supply air ducts, return air ducts, exhaust ducts, relief ducts, plenums, duct taps, grille taps, diffuser connections and all other related pieces and parts of the air conveying systems.

RESTROOM BUILDING

- 1.04 Before starting shop drawings or fabrication of any duct work, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, grille patterns, etc.

PART 2 - PRODUCTS

2.01 FANS

A. General Requirements for All Fans:

1. All fans constructed to AMCA Standards, AMCA listed and labeled.
2. Bearings:
 - a. At factory assembled package units 1HP and larger, provide 200,000 hour bearings (AFBMA L-50) selected at maximum fan rpm.
 - b. At packaged equipment 3/4HP and smaller, provide manufacturer's standard bearings.
 - c. Arrange equipment for easy access to lubrication fittings. Provide extended grease lines whenever easy access is not possible.
3. Balance fans statically and dynamically at factory.
4. Factory paint fan housing, fan wheel (except aluminum), frame and support brackets with prime coat and enamel finish coat at factory, after properly preparing surfaces.
5. Arrange fans to be cleanable and so that wheel, bearings, shaft, and drive are removable. Provide plug type cleanout doors or split fan housing. Gasket joints and bolt airtight.
6. Provide vibration isolation for all fans per manufacturer's recommendations.
7. Assemble fans at factory and test with permanent motor for proper operation, alignment and balance.
8. **All fans are to be of similar size and operational characteristics as fans scheduled. Smaller fans run at higher speeds will not be accepted.**

B. Belt Drives (All Belt Driven Fans):

1. Provide V-belt drive with sufficient belts to prevent slipping at start-up. Select drive for 1.5 service factor.
2. On each fan 10HP and smaller, provide variable pitch drive sheave with infinitely adjustable pitch diameter. Select drive sheave and fan pulley combination to provide fan rpm with drive adjusted to near mid-span.
3. Provide belt guard with hinged tachometer cap.

C. Roof Mounted Exhaust Fans:

1. Direct drive or have adjustable pitch v-belt AS SCHEDULED.

RESTROOM BUILDING

2. Wheels shall be backward curved and housing shall be removable or hinged aluminum.
3. Isolate motor with vibration dampeners.
4. **Provide with motorized backdraft dampers unless gravity backdraft dampers are specifically listed on schedule. Damper actuator voltage to match fan voltage. Electrical Contractor to tie damper in to fan power.**
5. **Insulated, pre-fabricated metal roof curb shall be for flat or sloped roof as required for fan to be set level on roof.**
6. **Provide with galvanized bee screen.**
7. Maximum motor rpm is not to exceed scheduled rpm by more than 50 rpm.
8. Provide with 12" high roof curb to match roof slope. Curb to minimum of 12" above finished roof.
9. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

D. Ceiling Exhaust Fans:

1. Centrifugal wheel with inlet perpendicular to, or remote from, inlet grille. Acoustically insulated housing.
2. 85% free open area grille.
3. Electrical junction box on fan housing with cord, plug, and receptacle inside housing.
4. Fan, motor and wheel assembly removable through grille without disturbing housing.
5. **Motor mounted on rubber-in-sheer isolators, grounded, maximum rpm shall not exceed scheduled rpm by more than 50 rpm.**
6. Unit supplied with grille when indicated by model number scheduled.
7. Provide and install roof cap or wall cap as shown.
8. Unit UL labeled.
9. Integral backdraft damper, shatterproof, with no metal to metal contact.
10. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

2.02 FAN ACCESSORIES

A. Flexible Fan Connectors:

1. Provide at inlet and discharge of each fan, ERV, MAU, air handling unit, etc.
 - a. For Standard Application:
 - 1) Material suitable to withstand the pressure encountered. Constructed from coated heavy glass fabric, flameproof and ozone resistant. Joints to be sealed airtight. Minimum of 3" flex connection to be used.

RESTROOM BUILDING

- 2) Manufacturer: Duro-dyne Corporation "EXCELON" or equal.
- b. For Outdoor Installations and Where Duct is Exposed to Toxic Fumes:
 - 1) Material suitable to withstand the pressure encountered. Constructed from heavy glass fabric, double coated with "Neoprene", non-combustible and fire retardant. Fabric to be waterproof and airtight. Minimum of 4" flex connection to be used.
 - 2) Manufacturer: Duro-dyne Corporation Duralon or equal.
2. Insulate over flex connection at inlet and discharge of all air handling units and rooftop units with minimum two inch (2") Type "C" insulation with minimum installed "R" value of 6.0. Seal termination of external insulation to ductwork with Childers CP-11 mastic with 3" glass fiber reinforcing mesh. Do not seal over any access panels.

2.03 DUCTWORK

A. Low Velocity Ductwork Systems:

1. Definition: Ductwork systems where duct pressures do not exceed 2" W.G. maximum static pressure and duct velocity does not exceed 2000 FPM. **Minimum duct gauge to be 26 gauge.**
2. All ductwork connected to louvers is to be sloped back to louver to insure that any water entering the duct drains back to the exterior of the building.
3. Ductwork Construction:
 - a. Ductwork, unless otherwise specified herein, shall be constructed of new, prime grade, continuous hot dip mill galvanized, lock forming quality steel sheets and shall have a galvanized coating of 1-1/4 ounces total for both sides per square foot. The gauges of metal to be used and the methods of duct construction shall conform to the requirements for the class of work involved as set forth in the latest edition of "Standard Practice in Mechanical Sheet Metal" as published by SMACNA. Each sheet shall be stenciled with the gauge and manufacturer's name. If coil steel is used, coils shall be stenciled throughout on ten foot (10') centers with the gauge and manufacturer's name. Insulate per Specification Section 20 07 00.
 - b. All dimensions are inside clear dimensions. Sheet metal size shall be increased to allow for duct liner where applicable.
 - c. Seal all transverse joints, seams and fitting connections with "Ductmate Proseal", Childers CP-146 or Foster 32-19, UL listed Mastic to prevent air leakage. Oil base caulking and glazing compounds are not acceptable. Duct sealant must meet VOC units per South Coast Air Quality Management District (SCAQMD) Rule #1168.
4. Rectangular Ducts:
 - a. Where special rigidity or stiffness is required, construct ducts of metal two gauge numbers heavier.

RESTROOM BUILDING

- b. Ducts larger than 96" require special field study for gauging and supporting and supporting methods. (Furnish shop drawings for supporting and construction requirements.)
 - c. Rectangular low pressure ducts shall be constructed, braced and reinforced in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
5. Round Ducts:
- a. Construct round ducts from steel sheets, U.S. Gauge thickness, per SMACNA standards.
 - b. All exposed round ducts shall be double wall spiral duct per SMACNA standards with segmented fittings regardless of size.
 - c. Supply, return and exhaust duct runouts to/from air device shall be gauges as follows:
 - 1) up to 12" diameter 30 gauge,
 - 2) 14" to 18" diameter 28 gauge, and
 - 3) 20" to 22" diameter 26 gauge.
- Provide minimum 26 gauge, 1" wide strap on heal and throat of adjustable fitting to provide additional rigidity.**
6. Transitions:
- a. Provide tapered transitions at changes in duct size and at connections to fans and other equipment.
 - b. Offset not more than 20°, on diverging flow and 30° on contracting flow, unless called for otherwise on drawing.
7. Elbows and Turning Vanes:
- a. Use long radius, 45° and 90° fittings for all elbows and at tees, unless otherwise shown or space restrictions dictate use of square elbows.
 - 1) Construct fittings with centerline radius equal to 1-1/2 times the duct width at the turn.
 - 2) Where square vaned elbows are used, provide access doors as detailed below.
 - b. Turning Vanes: In all 90° turns in supply air ducts where 1-1/2 radius elbows cannot be used, install double radius turning vanes in square elbows.
 - 1) Ducts 19" and Smaller: Use small double vanes with an inner radius of two inches (2") and an outer radius of one inch (1") mounted on 3/4" center.

- 2) Duct 19" and Larger: Use large double vanes with an inner radius of four inches (4") and an outer radius of two inches (2"), mounted on three (3) 1/4" centers. Provide sound reduction type turning vanes: "Airsan" Acoustiturn, by Air Filter Corporation, "Sone-Turn" by Sound Control Products Company, per SMACNA Plat 22, or equal.
- 3) **Provide 12" x 12" insulated access door into duct on both sides of each vaned fitting to facilitate duct cleaning.**

8. Flexible Duct:

- a. Do not use flexible duct except where specifically called for on the plans.
- b. At diffuser connections:
 - 1) Provide duct listed as UL-181 Class I air duct, and constructed in compliance with NFPA 90A.
 - 2) **Minimum length 4 feet, maximum length 5 feet for supply ducts. Minimum length 4 feet, maximum length 5 feet for return air ducts. Install with not more than one (1) 90 full radius degree bend. Minimum and maximum lengths are to be closely followed since the flex duct acts as the main source of sound attenuation in the air system. Install with some slack in runout.**
 - 3) Make joints with Nashua brand UL181A-P Duct Tape (Venture #1599B or Shurtape #PC857) and two (2) 1/2" wide positive locking straps, one on inner core and one on outer jacket. Use Panduit straps.
 - 4) Minimum sound net insertion loss for duct as follows:

BAND, HZ	125	250	500	1000	2000
Loss dB/ft.	2.1	3.0	2.7	3.0	2.7
 - 5) Submit sound and construction data for proposed alternates.
 - 6) Tough vapor barrier reinforced metalized polyester jacket, tear and puncture resistant.
 - 7) Airtight inner core with no fiberglass erosion into airstream.
 - 8) **R-Value: 6.0 @ 75°F. mean temperature if within building insulation envelope, or R-value of 8.0 if outside building insulation envelope.**
- c. Do not use flex duct on exhaust systems.
- d. Manufacturers: **Atco 36 Series**, Certainteed, Thermoflex, Wiremold, Genflex, approved equal.

RESTROOM BUILDING

- B. Entire interior of ducts shall be thoroughly cleaned of all oil residue and dust prior to installing.

2.04 DUCT ACCESSORIES

A. Air Volume Controls:

1. Provide air volume dampers, or other control devices, at each low pressure duct main and branch for a balancer to adjust the system to produce the air quantities shown.
 - a. Provide opposed blade damper for balancing in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.
2. Volume Dampers:
 - a. Flat sheet, single leaf damper with a continuous rod; damper leaf two (2) gauges (minimum 16 gauge) heavier than the duct where installed. Provide locking quadrants with indicators located accessible without demolition.
 - 1) Use for supply, return and exhaust ductwork 14" round or 14" x 14".
 - b. The locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with **stand-off mounting brackets, bases or adapters to provide clearance, between the duct surface and the operator, not less than the thickness of the insulation.** Stand-off mounting items shall be integral with the operator or a standard accessory of the damper manufacturer. All volume dampers indicated shall be provided with stand-off mounting brackets as required.
 - c. **All operators accessible and lockable. Do not insulate over top of volume damper operator handle.**
 - d. Locate dampers a minimum of 4 feet from diffusers.
3. Extractors:
 - a. Combination air straightening vanes and volume control with locking quadrant on outside or accessible through face of register.
 - b. Manufacturer: Titus AG-45 or approved equal.
 - c. Provide extractors at supply grilles attached directly to any main or branch duct serving more than one (1) grille.
4. Splitter Dampers:
 - a. Construct damper using sheetmetal blade hinge mounted inside duct.
 - b. Dampers or splitters shall be constructed from the same gauge metal as the ducts which they serve with a minimum of 22 gauge. Splitter length shall be 1-1/2 times the duct width up to 24" in size and above 24" in size shall be 1-1/4 times the duct width.
 - c. Attach Duro-dyne SRP-40 series splitter damper bracket to blade.

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- d. Connect 1/4" steel rod to damper bracket and extend through Duro-dyne SRP-14 ball joint damper casting mounting on outside of duct. Use 3/8" steel rod for splitter in ducts above 24" in size.
 - e. Install assembly for full swing of damper blade. Lock damper in proper position.
- 5. Opposed Blade Dampers:
 - a. Provide opposed blade balancing dampers with multiple blades equal to Greenheck VCD-15, 20 gauge frame and 16 gauge blade construction with synthetic axle bearings and 1/2" diameter operator, complete with 1" stand-off and manual locking quadrant as follows:
 - 1) Use for outside air ductwork. Minimum damper size is actual duct size or 10" x 10" whichever is larger. Provide transitions as required.
 - 2) Use for supply, return and exhaust ductwork - 14" round or 14" x 14" and larger.
 - b. Damper material is to match ductwork material. (i.e., galvanized aluminum, stainless steel, etc.)
- B. Gravity Backdraft Dampers:
 - 1. Provide backdraft dampers counter balanced to desired static pressure setting. Wide open static pressure drop not to exceed 0.15" W.G.
 - 2. Damper blades aluminum with felt applied to tops of blades. Where dampers are exposed to outside temperature, provide neoprene edged blades.
 - 3. Damper frames extruded aluminum; nylon bearings.
 - 4. Assembly designed for operation at 20°F.
- C. Access Panels and Doors:
 - 1. Low Velocity System Access Panels:
 - a. Sheetmetal doors reinforced, cross-bracketed or otherwise stiffened to prevent rattle or vibration.
 - b. Seal doors airtight with felt edged gaskets.
 - c. Secure with hinges and sash locks.
 - d. Panels and doors for insulated duct systems are to be insulated.

2.05 GRILLES, REGISTERS AND DIFFUSERS

- A. Provide grilles, registers, and diffusers of the types and sizes called for on plans and in schedule on drawings.

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- B. Finish with factory applied finish for extruded aluminum items, and with a prime coat for steel items. (Provide an additional factory baked enamel finish to match ceiling grid.) (Submit color sample for approval.)
- C. Equip diffusers with panels of the proper size to match the suspended ceiling layout or with the proper frame for surface mounting. Fully correlate diffuser and grille style, dimension and fit with ceiling.
- D. Manufacturers: Price, MetalAire, Titus, Tuttle & Bailey, Krueger, Anemostat, Carnes
- E. All air devices located in damp areas are to be constructed from all aluminum components.
- F. Provide minimum 12" deep externally insulated boot for sidewall type supply air devices.
- G. Provide square to round transitions as required.
- H. Provide minimum 12" deep (top duct tap) or 24" deep (side duct tap) externally insulated boot for return air and transfer air devices.
- I. Provide minimum 12" deep boot for all exhaust devices.

2.06 LOUVERS AND HOODS

- A. Provide air exhausts through building skin, as shown.
- B. Louvers:
 - 1. Size as shown; air pressure drop not to exceed 0.15" W.G. when handling 1150 FPM per square foot of free area.
 - 2. Water penetration not to exceed .02 oz. per sq. ft. when handling 1150 FPM per square foot of free area.
 - 3. 4" deep drainable louver constructed of .125" thick 6063-T52 extruded aluminum alloy with channel frame.
 - 4. **Provide with 1/8" X 1/8" galvanized hardware cloth bee screen.**
 - 5. Finish to be factory primed for field painting or applied .7 mil thick anodized dark bronze as directed by Architect.
 - 6. Manufacturers: Greenheck ESD-403, Arrow, Carnes, Greenheck, Ruskin, Empco, Pottorff, or approved equal.
 - 7. Any plenum or ductwork attached to louver is to slope to drain back through louver to exterior of building.
- C. Hoods:
 - 1. Construction of heavy duty aluminum sheets with rolled interlocking seams with galvanized hood support members, similar to Greenheck Fabrahood or equal.
 - 2. Provide with bee screen on outside air intake hoods and 1/4" x 1/4" galvanized bird screen on relief hoods.

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3. **Curbs are to be a minimum of fourteen inches (14") high above finished roof surface and match slope of roof.**
4. Manufacturers: Greenheck, Acme, Penn, Cook, Briedert and Carnes.
5. Provide 120 volt motorized damper.

2.07 AIR FILTERS

A. General:

1. All air filters to be listed as Class 2 by Underwriters Laboratory, Inc., Building Materials Directory.
2. All arrestance, efficiency (dust spot efficiency on atmospheric air) and dust holding capacities specified are to be in accordance with ASHRAE Standard 52-76.
3. Performance characteristics are to be verified by certified data published in manufacturer's literature or by copies of current test data from an independent authorized test laboratory. Test data, where required, shall be an integral component of the manufacturer's submittal data.
4. Provide and install one (1) clean set of filters in all air moving units that require filtration at completion of project.

B. Disposable Panel Filters (for return air filter grilles and/or unit filter racks):

1. Media: Non-woven, lofted cotton bonded to 96% free area welded wire support grid. Not less than 2.45 square feet media area per square foot of filter face area. Arranged in radially pleated configuration and bonded continuously to inside perimeter of high wet-strength beverage board cell sides.
2. Cell Design: Two inches (2") deep with beverage board diagonal supports at entering air and leaving air faces of each cell.
3. Air Cleaning Performance: Minimum 25-30% efficiency 90-92% arrestance, MERV-7.
4. Initial Resistance: 0.2" W.G. at 500 fpm face velocity.
5. Dust Holding Capacity: Not less than 200 grams when operated at 500 fpm face velocity to a final resistance of .9 W.G.
6. Manufacturers: Cam-Farr Company Aeropleat II; AAF or approved equal.

C. Temporary Filters:

1. Reference 20 00 00, 3.07 for temporary filter requirements.

2.08 UNIT HEATERS (ELECTRIC)

- A. Provide UL listed electric unit heaters with voltage, phase, number of steps, heating and air delivery capacities, as scheduled. Suitable for vertical and horizontal mounting.
- B. Casings fabricated of die-formed heavy gauge steel and finished in high gloss baked enamel.

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- C. Steel finned tubular element. Provide automatic reset thermal cutout for each element.
- D. Individually adjustable discharge louvers.
- E. Thermostat to match number of heater control steps. Wall mount or built-in as scheduled.
- F. Provide angle support between unit heater threaded rod supports and nearest wall to prevent unit sidesway.
- G. Manufacturers: Markel, Brasch, Modine, Trane, Berko or approved equal.

2.09 FIRE DAMPERS

- A. Provide and install all fire dampers in all ductwork which passes a fire wall or fire rated ceiling as required by local building and fire safety codes.
- B. All dampers folding blade type with no part of blade in the air stream.
- C. All fire dampers UL approved and of type required by NFPA 90A.
- D. Install all fire dampers per manufacturer's instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit.**
- E. Provide UL rated sleeves and manufacturer supplied wall angles with damper.
- F. Provide four additional fire dampers to be sized and installed as directed by Architect.
- G. Manufacturers: Ruskin, Air Balance, Arrow, Greenheck, Nailor or approved equal.

PART 3 - EXECUTION

3.01 LOW VELOCITY DUCTWORK

- A. Provide ductwork in accordance with SMACNA low velocity standards.
- B. Provide backdraft dampers for all exhaust fans if motor operated dampers are not called for. Provide one inch (1") mesh bird screen at all exhaust discharges.
- C. Seal all transverse joints, seams and fitting connections with KINGCO 11-376 "Super Seal" or "Ductmate Proseal", U.L. listed.
- D. Where ducts, exposed to view, pass through walls, floors or ceilings, furnish and install sheetmetal collars to cover the voids around the duct.
- E. This work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling or vibration and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner.
- F. Duct shall be erected in the general locations shown on the drawings, but must conform to all structural and final conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site, and shall make all necessary changes in cross sections, transitions, offsets, etc., whether they are specifically indicated or not at no additional charge to the Owner.

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- G. Reinforce all ducts to prevent buckling, breathing, vibration or unnecessary noise, such reinforcing to be as recommended in the SMACNA manual plus any additional reinforcing as may be required to meet job conditions.
- H. Provide manually operated volume control dampers (with stand-off mounting brackets for externally insulated ductwork) in all branches, splits and taps for proper balancing of air distribution, whether shown on drawings or not, dampers to be either single blade or multi blade as shown in the SMACNA manual as required. They shall incorporate an indication device with lock to hold damper in position for proper setting.
- I. Damper operators in all unfinished areas shall be Young Series 400 of the exact style, type and size required. All other operators shall be Young #315 and/or #896 opposite end from the operator. Where dampers are installed in ducts located above accessible type ceilings, damper operators shall not be extended through the finished ceiling.
- J. All square elbows shall have turning vanes per the SMACNA manual requirements.
- K. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using "Ventglas" fabric that is fire-resistant, waterproof, mildew-resistant and practically air tight, and shall weigh approximately thirty ounces per square yard. There shall be a minimum of two and one-half inches (2-1/2") distance between the edges of the ducts. There shall be a minimum of one inch (1") of slack for each full inch of static pressure on the fan system.
- L. Furnish and install screens on all ducts, fans, etc. furnished by the Contractor which lead to, or are outdoors. Screens shall be 16 gauge, three-eighths inch (3/8") mesh in removable galvanized steel frames.
- M. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punches (not pin punches), and shall not be larger than necessary. All duct openings shall be provided with sheetmetal caps if the openings are to be left unconnected for any length of time. All panels of ducts twelve inches (12") and larger shall be cross broken.
- N. Furnish and install a minimum 16 x 16 x 2 internally insulated (foil facing to airstream) filter rack with a hinged type access door with cam or spring lock and filter in all unfiltered raw outside air ducts that connect directly to return air plenums.
- O. **All ductwork that is connected to any exterior louver or wall cap, etc. shall be sloped to drain outside.**

3.02 DUCTWORK SUPPORTS

- A. Support all ductwork to prevent sag, undue play, and swing. All horizontal ducts shall have a support within 2' of each elbow and within 4' of each branch intersection. Provide a hanger within twelve inches (12") from unit supply and return. Return air plenums on back of air handling units must have a minimum of four (4) support straps.
- B. Low Pressure Ductwork:
 - 1. Duct 40" and Less: Provide with 1" x 18 gauge straps fastened to ductwork, and to building construction. Space not more than eight feet (8') on center. Hanger straps shall lap under duct a minimum of one inch (1") and have a minimum of one (1) fastening screw on the bottom and two (2) on the side.

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- C. Vertical ducts supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles.
- D. Recommend methods of fastening bracing to ductwork, including riveting, bolting and tack welding.
- E. All flex duct runouts must be properly supported. Use minimum twelve (12) gauge wire with 8" long saddle that fits up to mid point of duct for support of flex duct. **Web Type fabric duct support is strictly prohibited.** Maximum permissible sag is 1/2" per foot of spacing between supports.
- F. Provide 1" x 20 gauge straps, minimum 8' - 0" o.c. for all round sheetmetal runouts that are 18" in diameter or less (except Spiral Ducts).

3.03 ACCESS

- A. Furnish all fans with consideration of location of motor and drive.
- B. Furnish and install in the ductwork, hinged access doors to provide access to all manual and automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. In rectangular ducts larger than twenty inches (20") in their smallest dimension, install access doors every twenty feet (20'). Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"). Factory fabricated doors as manufactured by Milcor meeting these specifications will be acceptable. Access doors shall be submitted for approval.
- C. Each fire damper door shall have a label with letters not less than 1/2" in height reading "**Fire Damper**", "**Corridor Ceiling Fire Smoke Damper**" or "**Fire/Smoke Damper**" (as applicable).
- D. Cycle damper after installation to insure free movement. Seal opening around fire damper with non-combustible material to maintain integrity of one (1) hour fire wall.
- E. Provide access door in supply air and return air drops from rooftop units, Access door to be in accessible location directly above first elbow. Access doors to be 18" X 18" minimum where duct size allows. Access doors shall be shown on ductwork shop drawings.
- F. Provide access doors for maintenance inspection and cleaning in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

3.04 Fully coordinate and work directly with the Balancing and Testing Agency to provide all systems in perfect operating order. Make corrections and adjustments as required by the Balancing and Testing Agency in a timely manner.

3.05 For Each Dryer: Provide 4" diameter or 5" x 3" rectangular flue pipe up through the wall and ceiling cavity and terminate into Briedert Cap. Provide transitions as required. Provide 4" diameter tie in point for residential type dryer or stacked washer dryer as required.

3.06 **CAP OPEN ENDS OF ALL DUCTS (INCLUDING SPIN-INS) AND EQUIPMENT WITH MINIMUM FOUR (4) MIL. PLASTIC TO PREVENT CONSTRUCTION DEBRIS AND DUST FROM ENTERING OPENINGS AT ALL TIMES DURING CONSTRUCTION.**

END OF SECTION

DIVISION 26

RESTROOM BUILDING FOR

CITY OF DEER PARK SOCCER COMPLEX

ELECTRICAL SPECIFICATIONS

CONTENTS:

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B.J. Hendrix

03/08/2017

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SECTION 26 05 00 - GENERAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

Unless otherwise specified, provide all labor, equipment, supplies, materials, superintendence and testing necessary for the installation of complete electrical systems as required by these specifications and as shown on the Drawings, subject to the terms and conditions of the contract. Complete such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the Drawings. Include empty conduits as required for all special systems and power for condensate pumps and HVAC control panels as required by the Mechanical Contractor. Field coordinate exact locations.

- A. Submit a bid on the basis of a complete installation, including all labor, material, cartage, insurance, permits, associated fees and taxes.
- B. Include temporary electrical power and lighting that will be required for the interior of the buildings. Provide lighting to satisfy OSHA requirements and the NEC.
- C. All Agreement Forms, General Conditions, Supplementary Conditions, and Division 1 of the specifications shall apply to the work specified in Division 26-28.
- D. Additional Site Visit Costs: The Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.
- E. No attempt has been made to show complete design details of building construction on the Electrical plans. Refer to Architectural, Structural and Mechanical plans for additional details which will affect electrical work. No extra cost will be allowed for offsets in conduit and wiring to avoid other work or when minor changes are necessary to facilitate installation or maintenance.
- F. Electrical Contractor is to provide all parts and labor to make final connections to all equipment shown in contract documents. Power may be shown in general location, it is expected that Electrical Contractor coordinate final locations for rough-in and connection requirements with exact equipment being installed. These items include but not limited to book security, exhaust fans, kilns, hand dryers, sensor operating plumbing devices, overhead doors, powered curtain, fire alarm door hold opens, etc.
- G. **NO TOXIC NOR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED.**
- H. AN EXTRA COPY OF ALL FIELD REPORTS SHALL BE KEPT IN A SEPARATE NOTEBOOK. CONTRACTOR TO SET UP IN THE CONSTRUCTION MANAGER'S TRAILER. THESE REPORTS SHALL BE USED FOR CONTRACTOR TO CHECK THAT EACH INDIVIDUAL ITEM NOTED HAS BEEN COMPLETED. ALSO KEEP LOG OF WHERE EXTRA RECEPTACLES AND OUTLET BOXES CALLED OUT IN 26 27 26, 3.01 AND 26 05 80, 2.01. ARE INSTALLED.
- I. **Electrical Contractor shall use Fire Alarm Contractor's Shop Drawings and Rough-In details on drawings for rough-in of all fire alarm devices. Any devices not roughed-in according to Fire Alarm Shop Drawings and drawing details shall be relocated at no cost to Owner.**

- J. Sensor Operated Plumbing Devices: Plumbing Contractor to provide transformers from manufacture. Electrical Contractor to provide all other electrical materials and labor to provide complete and workable device. This includes but is not limited to receptacles for plug in transformers, line voltage wire/conduit for direct connect low voltage transformers, all low voltage plenum rated 16 gauge wire.
- K. **Cad Drawings:**
Architectural Background Files – Architectural Files are background files, MEP drawings are not background files. To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.
- MEP Drawings** – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of \$500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.
- MEP CAD Files that will be released.**
- If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
 - Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
 - Fire Alarm/Fire Sprinkler/Intercom etc... Contractors must use Architectural Revit Models and CAD files for backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. This must be obtained from Architect. Engineer may not release architectural drawings.
- L. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner hereto in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.
- M. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures and for coordinating all portions of the Work under his Contract.
- N. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.
- O. Provide a completed Schedule of Values, see Specification Section 26 05 10. Preliminary schedule of values shall be submitted to Architect/Engineer for review.

RESTROOM BUILDING

1.02 SITE INSPECTION

- A. Prior to Bidding, the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.
- B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.
- B. Provide electrical connections and service to items described in all other sections of these specifications.
- C. The Electrical Contractor shall provide all wiring and connections required to fire/smoke dampers. Coordinate exact locations of dampers with Mechanical Contractor and relay requirements with Fire Alarm Contractor.
- D. The Electrical Contractor shall provide all wiring and connections required to backdraft dampers at exhaust fans. Coordinate exact locations of dampers with Mechanical Contractor.
- E. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

1.04 WORK NOT INCLUDED

- A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.
- B. Unless otherwise indicated, motors shall be furnished by others, but connected by the Electrical Contractor as indicated on the Drawings.
- C. Unless otherwise specified, Mechanical equipment control low voltage wiring (less than 50 VAC) shall be provided and installed by the Mechanical Contractor.

1.05 SPECIFICATION TERMINOLOGY (Definitions)

- A. "Provide": Includes all material, installation, labor subcontracts, appurtenances and mark-up required for a complete operable system as shown and specified, set in place, connected and ready to use.

RESTROOM BUILDING

- B. "Furnish": Purchase and deliver to job site, material as shown and specified.
- C. "Install": Includes all installation, labor subcontracts, appurtenances and mark-up required for complete installation of equipment furnished by others.
- D. **"Record Drawings": Drawings that reflect the electrical systems as actually constructed by the Contractor including conduit routing.**
- E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. All clearances per NEC.
- F. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- G. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit system.
- H. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, imbedded in construction, crawl spaces, etc.

1.06 DIAGRAMMATIC DRAWINGS:

- A. The drawings are in general diagrammatic, and the location of outlets, switches, motors, etc., on the drawings does not necessarily mean that such units shall be placed at that exact spot, as scaled on the drawings, but shall be located to function best. Use the drawings, and these specifications for guidance and secure the Engineer's approval of all changes in location. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.
- B. Verify all measurements at the site. No extra compensation will be allowed because of differences between locations shown on the drawings and measurements at the building.
- C. The Contractor is to draw electrical rooms and service to scale **(1/4" minimum)** with actual equipment to be used and submit to the Engineer prior to installation. The Contractor must insure that all minimum NEC working clearances are maintained. Coordinate with equipment of other trades.
- D. Where lighting fixtures and other electrical items are shown in conflict with structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.
- E. The branch circuits and arrangement of home runs have been designed to compensate for voltage drop and other considerations to accomplish maximum economy. Re-circuiting will not be permitted without specific approval. **Circuit numbers may change to achieve balanced loads on panels.**
- F. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- G. Drawings and specifications are complimentary each to the other. What is called for by one shall be as binding as if called for by both.

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- H. Should the drawings disagree in themselves, or with the specifications, the better quality or greater quantity of work or materials shall be used.
- I. Outlets and switches obviously placed in a location not suitable to the finished room or area shall be removed and relocated when so directed by the Architect at no cost to the Owner. The Architect shall have the right to make any reasonable change in outlet locations before rough-in without additional cost to the Owner. The contractor shall contact engineer when switches are inadvertently shown on hinge side of door prior to rough-in.
- J. Location of light fixtures shall be coordinated with reflected ceiling plans and/or room finish schedules.

1.07 MATERIAL AND EQUIPMENT SUBMITTALS

- A. Submittals: Provide submittals for all products and systems described in Division 26-28 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.
- B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) submittal number will be returned and required to be broken into unique separate submittal numbers.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.
- C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**
- D. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**
- E. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section.** Separate PDFs for each Submittal number.
- F. **HARDCOPY SUBMITTAL REQUIREMENT:** Hardcopy submittals will not be required by Engineer.
- G. **PDF SUBMITTAL REQUIREMENT:**
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected.**

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays cause by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

- H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**
- I. **Submittals will be returned in order of construction of the project, not necessarily in order submitted.** If all sections are submitted under one binder/at one time and transmittal, each section will be returned at the appropriate time for construction phasing. Electrical Gear will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Electrical Gear and Light Fixtures may require extended review time. **If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.**
- J. **DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS.** Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications submittal will be required. (Highlight items that are different to allow for proper review.):
 - 1. Devices
 - 2. Safety Disconnect Switches
 - 3. Wire and Cable
 - 4. All Motor Starters
 - 5. Contactors
 - 6. Lamps
 - 7. Photocells
 - 8. Time Clocks/Lighting Contactors
 - 9. Fuses
 - 10. Cable Tray
 - 11. Emergency Power (Inverter) System
 - 12. Cabinets and Enclosures
 - 13. Distribution and Fuse Blocks

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14. Fire Rated Product Penetration Details.
 15. Gear Coordination Study (include in O&M manual)
- K. **PDF Submittals Allowed** for Product Cut-Sheets for are limited to the following items:
Separate PDF file for each Submittal number is required. Follow file format above.
1. Fire Alarm System (Product Data and Shop Drawings)
 2. Interior Lighting Fixtures
 3. Exterior Lighting Fixtures
 4. Transformers
 5. Intercom and Sound System (Product Data and Shop Drawings)
 6. Dimming Systems
 7. Clock Systems
 8. Motor Control Center
 9. Bus Duct
 10. Power Conditions
 11. Surge Arrestors
 12. Generator Set
 13. Transfer Switch
 14. Emergency Power (Inverter) System
 15. Electric rooms (coordinate with mechanical). Also, indicate other equipment and/or systems on plan.
 16. Switchboards
 17. Panelboards
- L. When requested, present samples of all materials proposed for use to the Engineer for his approval.
- M. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.
- N. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.
- O. **Substitutions:** ("Substitution Request" form must be submitted)
1. Substitutions must be made and accepted PRIOR to Bid.

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2. Unless otherwise indicated, base bid on the equipment shown on the Drawings and hereinafter specified.
3. Request for approval to substitute materials, methods, or processes shall be made to Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.
4. All substitutions shall be of equal or better quality to the equipment specified.
5. Acceptance of the substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and completion of work on schedule.
6. It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity and other characteristics unless no substitutions are noted.
7. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**
8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**
 - a. Light Fixtures Packages
 - b. Alternate Transformers
 - c. Alternate Surge Protective Devices
 - d. Alternate Equipment/Gear Packages
 - e. Contractor Cost Savings Packages Requiring Substantial Review Time

1.08 SHOP DRAWINGS REQUIRED

- A. Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination.
- B. Architectural drawings must be used for backgrounds in preparation of shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

RESTROOM BUILDING

C. Reference other specification for additional requirements.

1. Fire Alarm
2. PA System
3. Electrical Rooms

1.09 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the specifications.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDAS ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THIS REQUIREMENT IS MET.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the site construction office as the work progresses. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Indicate locations of all existing active and inactive conduit uncovered during construction. **Keep marked up set at site for review at site meetings.**

D. **Contractor to indicate conduit routing locations for all major runs and branch circuits under slab along with major junction locations.**

E. The Contractor shall be responsible for updating all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job the marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contractor shall provide pdf copies/scans for owner record purposes. Remove Engineer's seal from record drawings.

G. The Contractor shall bear all the costs of producing the "Record Drawing Set".

H. Electrical riser diagrams shall be laminated and mounted in the main electrical room or as directed by the Engineer.

1.10 CODES, REGULATIONS AND ORDINANCES

A. Comply with the requirements of the National Electrical Code, National Electrical Safety Code, Occupational Safety and Health Act (OSHA) and all other applicable Federal, State and local codes and ordinances. All codes and standards shall be per the latest adopted edition with all supplements and official interpretations included. Provide disconnecting means for all equipment per NEC. The Drawings and specifications take precedence when they are more stringent than codes, standards, ordinances, and statutes take precedence when they are more stringent or conflict with the Drawings and specifications.

RESTROOM BUILDING

- B. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.
- C. All work shall also satisfy applicable local codes, ordinances, and regulations of the governing bodies, and all authorities having jurisdiction over the work. Where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Owner's representative and secure his approval before proceeding.

1.11 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

- A. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
- B. Retain all portable and detachable parts or portions of installation such as fuses, key locks, adapters, blocking clips, and inserts until final completion of work. Deliver parts to the Owner or his authorized representative and attach an itemized receipt to obtain request for final payment.
- C. Product Handling:
 - 1. Use all means necessary to protect the work and materials of this section before, during, and after installation and to protect the work and materials of all other trades.
 - 2. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.
 - 3. Store and protect materials and equipment in accordance with the manufacturer's recommendations.
 - 4. Provide suitable box or crate electrical equipment and cover with waterproof covers to protect against dirt, moisture or accidental damage during shipment or outdoors at the job site.
 - 5. Store all conduits on skids.

1.12 SERVICEABILITY OF PRODUCTS

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of piping, ductwork, equipment, conduits, junction boxes, panels and other products to allow proper service of all items requiring periodic maintenance or replacement.
- C. Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.

1.13 ACCESSIBILITY OF PRODUCTS

- A. Arrange all work to provide permanent, convenient and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

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- B. Provide access doors in ceilings, walls, floors, etc. for access to automatic devices and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.14 UTILITY COSTS

- A. Provide complete utility service connections. The locations and elevations of the various utilities included within the scope of this work have been obtained from city and/or other substantially reliable sources as a general guide only, without guarantee as to accuracy. Verify the locations, elevations, and availability of all utilities and services required, and be adequately informed as to their relation to the work.
- B. Include all service charges required by the electric utility or telephone/data/cable utility. Reference General Conditions for further information. Keep all utility company charges as a separate line item in bid. If cost is not available from utility company, indicate utility contact person, telephone number and **date of contact**.

1.15 CLEAN-UP

- A. Remove debris and waste materials from within the construction areas and transport off-site, daily.
- B. Keep the construction area clean, free from hazard, and orderly arranged.
- C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.
- D. Dispose of waste materials in accordance with all regulations which govern.
- E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.
- F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.
- G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Unless otherwise indicated, provide only new equipment and materials.
- B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.
- C. All materials furnished under these specifications shall be the standard product of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.

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D. Guarantees:

1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect and shall remain in effect for a period of ONE (1) YEAR thereafter.
2. All materials, items of equipment, all lighting, and workmanship furnished under each section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.
3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.
5. Furnish, before the final payment is made, a written guarantee covering the above requirements.
6. Reference other guarantee information elsewhere in these specifications.

2.02 STANDARDS

- A. Where the Underwriters' Laboratories (UL) have established standards and issued labels for a particular group, class or type of material, apparatus, appliance or device, provide the UL label on all such items in that category incorporated into the work.
- B. Where such items are not covered by UL standards, they shall meet or exceed the requirements of the current National Electrical Code (NEC), or if not covered there, by the applicable, published, recognized standard of the American National Standards Institute (ANSI), or of the industry and of the related engineering society. Example: National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers (IEEE).
- C. Contractor is to follow the most current version adopted for all codes and standards.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

- A. Carefully lay out all work in advance so as to minimize cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, etc. Perform all cutting, channeling, drilling, etc., as required for the proper support, concealment, installation, or anchorage of raceways, outlets, or electrical equipment in a careful manner. Any damage to the building, structure, piping, ducts, equipment, or defaced finish, tile, plaster, woodwork, or metal work shall be repaired

by skilled mechanics of the trades involved at the Contractor's expense and to the satisfaction of the Engineer. All cutting, channeling, chasing, or drilling of unfinished masonry, tile, etc., or cutting, drilling, anchoring to or welding of structural members shall be performed in a manner having the Engineer's prior approval. All openings made in fire rated or smoke rated walls, floors, and ceilings shall be patched and made tight in a manner to conform to the fire rating or smoke rating for the enclosure.

- B. Where conduits pass through exterior walls, thoroughly caulk with sealant the annular space around the conduit to provide a watertight closure at the interior wall cavity and exterior wall surface. Provide $\frac{1}{4}$ " maximum annular space around the conduit. Provide and install all counterflashing of all conduit, pipe and supports which pierces roofs and other weather barrier surfaces. Verify detail with Architect before installation. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at his expense, to Architect's satisfaction. All waterproofing, flashing and counterflashing shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect and Roofing Contractor.

3.02 SEALING AND FIREPROOFING

- A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**

1. Only materials tested in the specific UL System No. may be used.
 - a. Caulk Manufacturer:
 - 1) 3M Type CP-25 W/B + for all assemblies requiring 3M caulk.
 - 2) For WL3045 and WL3046 use Hilti FS611A sealant.
 - b. Steel Sleeve (stud wall) (UL System No. WL1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum two inch (2") lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus one inch (1") such that, when installed, the ends of the sleeve will project approximately $\frac{1}{2}$ " beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with conduit) to be 2 to 2- $\frac{1}{2}$ " larger than the outside diameter of conduit such that, when the steel sleeve is installed, a 1 to 1- $\frac{1}{4}$ " annular space will be present between the steel sleeve and the conduit around the entire circumference of the conduit. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.
 - c. Optional Steel Sleeve (concrete or block wall): Except for single insulated cables, provide sleeve cast in floor/wall or mortared into CMU wall; Schedule 40 or heavier, length to extend a maximum one inch (1") from top surface of floor or a maximum of one inch (1") from both sides of wall.

RESTROOM BUILDING

- d. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.
- 2. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies and one (1) side of floor.
- 3. Alternate floor penetration system (with firestop mortar): UL System No. CAJ1032.
- 4. Wires and Cables:
 - a. For gypsum frame wall, single cable: Fireproof per UL System No. WL3001. Opening for cables to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).
 - b. For gypsum frame wall, multiple cables: Use UL system No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.
 - c. For concrete walls/floors or CMU walls, single or multiple cables: Fireproof per UL System No. CAJ3030. Install sleeve in assembly flush with both sides. Cables to be a minimum of ten percent (10%) and a maximum of thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.
- 5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.
- 6. Materials used in firestop systems shall be installed in accordance with the manufacturer's written instructions (shall be posted at job site, in General Contractors trailer), provided with materials for specific UL System No.
- 7. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield or equal.
- B. In non-rated walls identified for sound insulation, provide 1/2" space between conduit and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.
- C. **Final condition to prevent passage of fire, smoke, noxious gas and water.**
- D. For non-rated electrical/mechanical rooms: Seal all conduit passing through room walls, floors and ceilings with 3M caulk, Type CP-25 WB+.

3.03 WORKMANSHIP AND COMPLETION OF INSTALLATION

- A. For the actual fabrication, installation and testing, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation. In acceptance or rejection of the installed work, no allowance will be made for lack of skill on the part of workmen.

RESTROOM BUILDING

- B. Install all specialties as detailed on plans. Where details or specific installation specifications are not included herein, follow approved manufacturer's recommendations.
- C. Install complete, thoroughly check, correctly adjust, clean, and leave ready for operation all equipment and material connected with this project.
- D. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.
- E. Electrical service stub locations, sizes and quantities for equipment are approximate only. The Contractor must verify all service locations, sizes and quantities with the equipment supplier before rough-in.
- F. The Electrical Contractor shall make all final connections to all electrical equipment furnished and set in place by others, including millwork with outlets. The Electrical Contractor shall provide and install all disconnect switches as required.
- G. The Electrical Contractor shall provide/install all circuit breakers, power wiring, conduit systems and final connections required for operation of heating cable systems.
- H. Provide and install all adjustable mounting brackets, steel bar hangers, T-bar mounting clips, support channels and universal support bridges as required for installation of recessed light fixtures, speakers, alarm devices and other ceiling mounted devices. Ceiling tile shall not be used to support ceiling mounted devices in lay-in ceilings.
- I. Provide wood trim for any semi-recessed panels installed. Verify finishes with the Owner/Architect.
- J. Provide Hoffman enclosure (#A-244208WFLP) wall mounted at location shown on plans. Provided in enclosure shall be spare fuses, three (3) of each amperage used in project up to 100 amp size and spare smoke detectors (see Section 28 31 00.)
- K. Equipment and materials shall be listed by an organization that evaluates products and states that the equipment or material, either meets appropriate designated standards or has been tested and found suitable for a specified purpose or shall be labeled by the manufacturer to indicate compliance with appropriate standards or performance in the specified manner to be used.
 - 1. Listed or labeled equipment and materials shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned in accordance with any instructions included in the listing or labeling.
- L. The installation shall be performed by licensed, competent workmen to provide a thorough and complete installation.
- M. All work shall be accomplished in conjunction with other trades in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.
- N. Exact locations shall be determined by reference to the general plans and measurements at the building and shall be subject to reasonable change by the Owner's representative without additional cost.
- O. Prior to and during construction, provide adequate storage facilities and properly protect items subject to any damage. Failure to comply with this provision will be sufficient cause for the rejection of the particular apparatus involved.

RESTROOM BUILDING

- P. At completion, the installation shall be thoroughly cleaned. All tools, equipment, obstructions, temporary power, temporary lighting and debris shall be removed from the premises.

3.04 BALANCING SYSTEM

- A. Balance the electrical system between the respective phases of the system. Balance individual circuits in each panel of the system. Where phase assignments or circuit numbers are indicated on the drawing, do not deviate without the Engineer's approval. All deviations shall be noted on panelboard submittals and on Record Drawings and schedules

3.05 COOPERATION WITH OTHER CONTRACTORS

- A. Cooperate with other Contractors so that the installation of the electrical materials and equipment may be properly coordinated. Where a conflict occurs with piping, duct work, etc., it shall be resolved as directed by the Engineer.
- B. Interferences between conduit and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed:
 - 1. Building Lines
 - 2. Structural Members
 - 3. Drainage Waste and Vent Piping
 - 4. Refrigerant Piping
 - 5. Ductwork
 - 6. Water and Gas Piping
 - 7. Electrical Conduit
 - 8. Fire Protection Piping

3.06 COORDINATION OF WORK

- A. Each Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing inter-related work. Before installation, all Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Locations of conduit and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of systems shall be determined prior to fabrication or installation.
- C. Offsets and changes of direction in all conduit systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.
- D. Where discrepancies in scope of work as to what Trade provides items such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems.

RESTROOM BUILDING

- E. Verify voltage, phases, termination points, termination requirements and required disconnects for all equipment provided as part of this contract or equipment furnished by Owner prior to rough-in. Report any discrepancies to Architect/Engineer.
- F. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.
- G. **The Electrical Subcontractor shall verify with HVAC, Plumbing and Fire Protection Subcontractors the required electrical characteristics for all motors and equipment before ordering and submitting of electrical gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**

3.07 SAFETY PRECAUTIONS AND PROGRAMS

- A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

3.08 OPERATING AND MAINTENANCE MANUALS

- A. Provide one (1) Operation and Maintenance manuals for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records
- B. Operating Sequence and Procedures:
 - 1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter.
 - 2. Typewritten Operating Procedures: Write procedures for start-up, operation and shutdown.
 - a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.
 - 3. Shutdown Procedures: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

RESTROOM BUILDING

- C. Maintenance Instructions:
 - 1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.
- D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide the nearest manufacturer's representatives name, address and phone number.
- E. Shop Drawings: Provide two copies of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturer's brochures or properly identified in a separate subsection.
- F. Spare Parts Lists: Include a list of all equipment furnished for the project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or systems. Properly identify each part by part number and manufacturer.

3.09 IDENTIFICATION

- A. Equip the following items with nameplates:
 - 1. Motor Starters
 - 2. Main Switchboard and Overcurrent Devices and Spares
 - 3. Panelboards and Branch Circuits
 - 4. Safety Disconnect Switches
 - 5. Contactors
 - 6. Control/Power Equipment in Separate Enclosures Including Relays
 - 7. Bypass Switches and Transfer Switches
 - 8. Emergency Generator Sets
 - 9. UPS System and Battery Racks
 - 10. Motor Control Centers
 - 11. Transformers
- B. No dymo (stick on indented plastic) type label will be permitted.
- C. Identify equipment listed above. COORDINATE EQUIPMENT NUMBERS WITH MECHANICAL AND/OR KITCHEN PLANS. Each piece of equipment shall be numbered consistently throughout.
- D. Fabricate nameplates as follows:
 - 1. Provide three (3) ply, 1/16" laminated plastic nameplate material with white core for lettering and black background. All nameplates, for equipment powered from emergency circuits, shall have white core for lettering and red background.

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2. Use capital letters.
 3. Unless otherwise indicated, provide minimum 3/4" high x 2" long nameplates with 1/4" letters.
 4. All labels shall be permanently affixed to the front of all required equipment using two (2) round head self tapping screws. Self-adhesive labels are not acceptable. Align labels with equipment.
- E. All junction boxes shall have the panel/circuit number(s) identified on the blank coverplate, handwritten with a permanent black marker. Disconnects, combination motor starter/disconnects and manual motor starter shall have the panel/circuit number(s) identified on the inside of the front cover, hand written with a permanent black marker.
- F. Provide engraved coverplates for all switches and control devices which are not otherwise clearly related to the equipment they serve.
- G. Label all receptacles and light switches with circuit number using electronic labeler (black on clear). Install label level on front of face plate for receptacles and back side of face plate for light switches.**
- H. Spray paint J-Boxes red for Fire Alarm System. All other special systems J-Boxes to be painted white.
- I. Color code all 600 volt insulated conductors by installing conductors with factory colored insulation for conductors No. 10 AWG and smaller.
- J. Install colored tape on all 600 volt conductors No. 8 AWG and larger. Apply tape 6 inches from terminal points. Do not cover factory applied cable identification markings with taping; tape locations may be adjusted slightly to prevent the covering of factory markings. Tape shall be Scotch No. 35 or approved equal, 7-mil thick by 3/4" wide vinyl adhesive tape.
- K. Install engraved plastic laminate nameplates as listed below.

EQUIPMENT	LETTERING SIZE	INFORMATION
Switchboards, Panelboards, MCCs and other distribution system overcurrent devices	1/4" / 1/8"	Switchboard name designation, ampere rating of the supply conductors, voltage characteristics, power source and room number(s). EX: MDP, 1900A, 480Y/277V, Served from Utility EX: HVA, 175A, 480Y/277V, source DP-1,3,5. in Room 100.
Transformers	1/4" / 1/8"	Transformer name designation, load served, power source and room number(s). EX: Trans. TR-1, serves PANEL LV-1, source DP-7,9,11 in Room 203.
Remotely mounted Safety Switches and Starters	1/8"	Load served, power source and room number(s). EX: HWP-1, HVA 37,39,4 1 in Room 203. EX: PANEL LV-2 in Room 303, source TR-2.
Contactors	1/8"	Load served, power source and room number(s). EX: Room 502, Science Lab, LVA 31,33 35, 37,39,4 1. EX: Building security lights, HVA 2, 4. EX: Parking lot lights, HVA 6, 8, 10.

RESTROOM BUILDING

- L. Prepare a neatly typed panelboard circuit directory. Identify all circuits by the equipment served and by the room number, room numbers may be different from those shown on drawings. Verify room numbers prior to typing directories. Indicate spares and spaces with light, erasable pencil marking.

3.10 TESTING

- A. Test and record results for all power feeders for Megger Readings, including phase to phase and phase to ground as recommended by the cable manufacturer.
- B. Measure and record service ground resistance.
- C. For equipment having ground-fault protection the ground-fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be submitted to the Engineer and a copy put in the Operation and Maintenance Manuals.

3.11 CERTIFICATE OF COMPLETION

- A. Submit, at time of request for final inspection, a completed letter in the following format:

I, (Name) , of (Firm) , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of (Date). I further certify that the following specification requirements have been fulfilled:

1. Megger readings performed, six (6) copies of logs attached.
2. Ground tests performed, six (6) copies of method used and results attached, including service ground readings and ground fault test results.
3. Operating manuals completed and instructions of operating personnel performed for all systems, (Date) , (Signature, Owner's Representative).
4. Record drawings up-to-date and ready to deliver to Engineer.
5. Fire alarm system final connections, check-out and start-up completed on (Date) by (Signature, Factory Authorized Representative and Trained Technician) .
6. All other tests required by Specifications have been performed.
7. Final clean-up is completed.
8. All systems are fully operational.

Signed: _____

3.12 SITE OBSERVATION

- A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.

- B. **It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense, billed at current Engineer's hourly rates.**
- C. The final acceptance of the work will be made jointly by the Architect and the Owner.
- D. Time spent for Investigation/Site Trips due to Contractor lack of installation capabilities/skills or knowledge is not part of Engineer's scope. Therefore time spent assisting contractor in these matters or problems that arise due to these matters will be billed to Contractor. Engineer will bill the contractor at the current hourly rates of the Engineer. These fees will be paid in full prior to release of contingency.

3.13 DURING FINAL INSPECTION

- A. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.
- B. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.

3.14 CLOSE-OUT DOCUMENTS:

- A. Furnish three signed letters of guarantee.
 - 1. Clearly and individually, document all material, equipment and service guarantees beyond a single year.
- B. Furnish one original and two copies, of a statement from the inspecting authority stating that the installation has been accepted and approved.
- C. Furnish one reproducible, two copies and an electronic "AutoCad" version, of complete, full-size sets of drawings showing conduit locations by accurate dimensions from permanent structures.
 - 1. **"Record Drawings"** are to include:
 - a. A sheet legend shall be present on the 1st sheet of the required set which identifies each sheet making-up the set.
 - b. Site plan(s) with primary and secondary electric power and communication lines to the property line (may be a civil sheet).
 - c. Site plan(s) with all underground conduits to other buildings, structures, fixtures and equipment.
 - d. Marked-up electrical plans and schedules.
- D. Furnish three complete sets of overload settings and motor data records.
- E. Furnish three complete sets of the electrical testing results.
- F. Furnish three complete sets of the power system study final report.
- G. Furnish all manufacturer's software if required for start-up or modifying products furnished.

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- H. Furnish two complete sets of the AC Drive's comprehensive manual that includes operation, programming, diagnostics, applications, wiring diagrams, layout diagrams, and outline dimensions.
 - 1. Identify each AC Drive's model number on a cover sheet.
- I. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format.

MEP/ENERGY CONSULTANTS



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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

- A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.
- B. 2 Submittal CATEGORIES (Reference Specifications)
 - a. Not required unless deviating from specification
 - b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:

For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures

Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:

Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

- C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.
- D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

- a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

- b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

RESTROOM BUILDING

- E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.
- F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.
- G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.
- H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."
- I. Call before submitting a written RFI.
- J. All formal Job emails must come from Architect.
- K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

- A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.
- B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.
- E. Schedule and Details sheets will not be released.

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SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

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The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph: _____

Drawings and Details Affected: _____

Proposed Substitution/Description: _____

Installer's Name: _____

Manufacturer's name: _____

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____ # of pages including cover)

Why is Substitution Being Submitted?

- ☐ Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
- ☐ Specified product is not available. Explain in detail as attachment.
- ☐ Cost Savings to Owner. Indicate comparative cost analysis as attachment.
- ☐ Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

- A. Does substitution affect dimensions shown on drawings? ☐ No ☐ Yes
- B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐ No ☐ Yes
- C. What affect does substitution have on other trades?
- D. Differences between proposed substitution and specified item?
- E. Indicate how proposed substitution meets LEED requirements. (if applicable)
- F. Manufacturer's guarantees of proposed and specified items are:
☐ Same ☐ Different (explain on attachment)

The Contractor and Subcontractor certifies:

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

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

For A/E Use: SR# _____

- ☐ Accepted ☐ Accepted as Noted
- ☐ Not Accepted ☐ Received Too Late
- ☐ Incomplete Information
- ☐ No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:

- ☐ FILE ☐ OWNER ☐ CONTRACTOR
- ☐ ENGINEER ☐ _____

MEP/ENERGY CONSULTANTS



COMMISSIONING • FIELD INVESTIGATIONS

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SECTION 26 05 10 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall breakdown the final Schedule of Values to be used for pay application into the following minimum categories.
- B. ALL CATEGORIES SHALL HAVE APPROPRIATE MATERIAL AND LABOR BREAKDOWN.**
- C. Definitions:
 - 1. Service: Conduit for utility company and conduit and wire from utility transformer to main switchboard.
 - 2. Feeders: Include all conduit and wire serving transformers and panelboards.
 - 3. Branch Circuit: Any circuit from a panelboard to a utilization device.
 - 4. Gear: Main switchboard, panelboards, transformers, disconnects, etc.
 - 5. Site conduit voice/data.

1.02 SCHEDULE OF VALUES

- A. Mobilization
- B. Utility Company Fees
- C. Service - Wiring and Conduit
- D. Site Light Fixtures, Wiring and Conduit
- E. Gear
- F. Interior Lighting Fixtures
- G. Branch Circuit - Wiring and Conduit
- H. Feeders - Wiring and Conduit
- I. Devices (switches and receptacles)
- J. Uninterruptible Power System
- K. Testing/Labeling of Equipment
- L. Record Drawings and O&M Manuals (\$1500 minimum)

END OF SECTION

SECTION 26 05 19 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide a complete system of conductors in raceway systems as shown on the drawings and hereinafter specified. Route all wire through an approved raceway unless otherwise indicated, regardless of voltage application.
- B. Provide 200% neutral conductors to all panels with 200% neutral specified. Reference Panel Schedules.
- C. Provide individual neutrals for each circuit, no shared neutrals allowed.**
- D. No de-rating of neutrals allowed.**

1.02 STANDARDS

Provide conductors in accordance with the applicable sections of UL and IPCEA Standards.

1.03 SUBMITTALS

- A. Furnish Engineer shop submittals for each type of wire and cable.
- B. Provide shop submittals which includes the following information:
 - 1. Insulation type.
 - 2. Insulation temperature rating.
 - 3. Manufacturer

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wire and Cables: (600 Volts)
 - 1. Provide copper wire and copper ground conductors **only**. Conductors shown on plans are thusly sized. **No aluminum conductors** will be allowed unless specifically noted.
 - a. Minimum wire size for branch circuits shall be #12, however, #14 may be used for motor control circuits where specified on the drawings.
 - b. All conductors #12 and smaller shall be solid and #10 and larger shall be stranded.
 - 2. Provide copper conductors of annealed, 98 percent conductivity soft drawn copper. Provide stranded conductors for control circuits.
- B. Metal clad cable shall not be acceptable except from junction box to light fixture, maximum 6 feet in length.**

C. Flexible metal conduit or metal-clad cable for receptacles and branch circuits with the following limitations:

- 1. Dry interior locations;**
- 2. Feeds one outlet only or first outlet.**
- 3. 20 amp maximum;**
- 4. Both segment ends are located within the same room.**
 - a. One segment end at the outlet box and the other segment end at a ceiling junction box located, within 10 feet of the entrance into the wall cavity, vertically above the outlet served.**
- 5. Where installed in an insulated wall, the cable must be on the conditioned side of the insulation and;**
- 6. Each cable or conduit shall be supplied by only one (1) branch circuit breaker (one, two or three poles).**
- 7. No MC to be horizontal in wall. All horizontal runs must be pipe and wire only.**

D. Insulation: (600 Volts)

1. Provide all conductor insulation types rated for wet and dry locations and approved by the National Electrical Code for the particular application. Provide all wire and cable with the following (or better) insulation classes:
 - a. All feeders and branch circuits are to be dual-rated Type THHN/THWN **copper** conductors.
 - b. Insulation rated for operation at 600 volts.
 - c. In areas where the temperature will exceed 167°F, provide wire rated 105°C. minimum and a type approved by the local code. Include any wiring within three feet (3') horizontally or ten feet (10') above any heating appliance.
2. Color code in accordance with the wiring diagrams furnished with equipment. All wiring for control systems to be installed in conjunction with mechanical and/or miscellaneous equipment. Color code by line or phase all branch circuit wiring including circuits to motors and feeders as follows: Wire No. 10 and smaller shall be factory color coded. Wire No. 8 and larger may be color coded by color taping within six inches (6") of exposed ends. **Color coding for each nominal voltage shall be consistent throughout building from point of origination to the termination point including tap conductors to luminaire. Mixing of colors between voltages will not be allowed.**

120/208 Volt
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White
Ground - Green

120/240 Volts
Phase A - Red
Phase B - Black
Phase C - Orange
Neutral - White
Ground - Green

277/480 Volts
Phase A - Brown
Phase B - Yellow
Phase C - Purple
Neutral - Gray
Ground - Green

RESTROOM BUILDING

- E. Wire and Cable: (50 volts or less)
 - 1. Provide copper wire, minimum size #18 AWG for controls, #18 AWG minimum for fire alarm and #20 AWG minimum for communications. All wire and cable shall be solid. Stranded conductors are not acceptable.
 - 2. All conductors shall be routed in conduit or shall have an insulation approved for plenum installation, unless otherwise noted.
- F. ROMEX not allowed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Unless otherwise indicated wiring size noted on the drawings extend for the entire length of a circuit. Install wire in raceways in strict conformance with the manufacturer's recommendations. Use a UL approved wire-pulling lubricant. Strip insulation so as to avoid nicking of wire.
- B. Wire Connections and Devices:
 - 1. Provide all terminating fittings, connectors, etc., of a type suitable for the specific cable. Make all fittings up tight. Make up all terminations in strict conformance with manufacturer's recommendations using special washers, nuts, etc., as required.
 - 2. Connect No. 8 and larger wire to panels and apparatus with properly sized, solderless, or compression lugs or connectors.
 - 3. Join No. 10 and smaller wire by twisting tight and applying UL listed twist-on connectors.
 - 4. Leave at least an eight inch (8") loop of wire for ends at each outlet box for the installation of fixtures or devices.
- C. Flashover or insulation value of joints shall equal that of the conductor. Provide connectors rated at 600 volts for general use and 1000 volts for use within fixtures.
- D. Grouping shall be 3 Hots and 3 Neutrals or 6 Hots max. Derating shall be based on the 90 degree chart of NEC 310-16 and table 310.15 (B)(2)(2).
- E. Where the distance between the supplying panel and the first branch circuit receptacle, light fixture or equipment is more than 100 feet, upsize wire to allow for maximum of 3% voltage drop for actual routing of conduit to device.
- F. Wiring for emergency systems shall be kept entirely independent of all other wiring and equipment as required by Article 700 of the NEC.
- G. Mechanically protect conductors by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use an approved wire-pulling compound when pulling conductors. Wiring pulling compound shall be listed and as recommended by the conductor manufacturer. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of the insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension.

RESTROOM BUILDING

- H. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.
- I. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- K. Neatly and securely bundle all conductors in enclosures using nylon straps with a locking hub.
- L. At least 6 inches (measured from the finished surface) of each conductor shall extend outside a box's opening.

3.02 SPLICES AND TERMINATIONS

- A. Splices shall be kept to a minimum.
- B. Splices shall be made in junction and/or pull boxes.
 - 1. Splices in conduit fittings (i.e., conduit bodies), and in panelboards are not acceptable.
- C. All materials shall prevent corrosion or electrolysis between dissimilar metals.
- D. Use terminal blocks within a junction box for all splices of No. 6 and larger conductors.
- E. Use mechanical, crimp or compression type connectors for terminations of stranded conductors.

3.03 CONDUCTOR SIZING

- A. Install conductor size required by the more stringent requirements of the drawings or specifications.
- B. Install No. 10 AWG conductors the entire length of the circuit for single-phase, 120-volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 100 feet.
- C. Install No. 10 AWG conductors the entire length of the circuit for single-phase 277 volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 200 feet.
- D. General use circuit numbers may be changed. Equipment circuits have numbering to balance loads. This contractor is responsible for maintaining a balanced load and recording the actual circuit numbers.
- E. Comply with ampacity adjustment factors as required by the NEC Article 310-16.

RESTROOM BUILDING

3.04 TESTING

- A. Prior to energizing feeders, perform insulation resistance tests at 500 Volts D.C. for 30 seconds on each cable with respect to ground and adjacent cables. Maintain the following log for feeder tests:

FEEDER DESCRIPTION: _____

TESTER'S NAME: _____

TEST INSTRUMENT SERIAL #: _____

TEST DATE: _____

RESISTANCE:

A-B

A-C

A-G

B-C

B-G

C-G

- B. Test all circuits for proper neutral connections.
- C. Upon completion of all testing, prepare a detailed report of all voltage and insulation resistance measurements. Deliver report to Engineer with request for final inspection.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide copper clad 5/8" x 8 ft. - 0" long ground rods, appurtenances, bonding plates, clamps, connectors and grounding conductors as required. Furnish rods to which the copper cladding is permanently and inseparably bonded to a high strength steel core.

2.02 CONNECTORS

- A. Provide exothermic weld type ground connections for concealed, underground, and concrete encased ground connections.
- B. Exposed connections may be made with copper or bronze bolted or compression lugs.

2.03 INTER-SYSTEM GROUNDING BUS-BAR (communications)

- A. Provide surface mounted terminal blocks sufficient to except 20 individual conductors of sizes 14 AWG thru 4 AWG.

2.04 CONDUCTORS

- A. Furnish copper conductors.
- B. Furnish 600-volt, insulated conductors for equipment grounding.
- C. Size the system grounding electrode conductors to comply with NEC section and table 250-66, unless shown larger.
- D. Size the main and separately derived system bonding jumpers to comply with NEC section 250-28 (D).
- E. Size equipment grounding conductors to comply with NEC section and table 250-122, unless shown larger.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Properly ground all service equipment conduit systems, supports, cabinets, equipment, motor frames, fixtures, etc., and the grounded circuit conductor in accordance with the latest issue of the National Electrical Code. Provide all bonding jumpers and wire, grounding bushings, clamps, etc., as required for complete grounding. Route ground conductors to provide the shortest and most direct path to the ground electrode system. Bond conduit if made of current conducting material. All ground connections shall have clean contact surfaces. Bond the service equipment to a grounding electrode as shown on the Drawings.

RESTROOM BUILDING

- B. Provide a grounding type bushing for all feeder and branch circuit conduits which do not have a grounding conductor and individually bond this raceway to the enclosure's ground bus or lug.
- C. Provide a grounding type bushing on the end of each isolated section of metal conduit and bond the conduit to the equipment grounding conductor, or using a conductor of the same size, bond directly to the equipment ground buss of the equipment at the end of the run.
- D. Make single or dual connections to ground rods, plates, and other buried connections by the exothermic process (Cadweld) or Burndy Hyground TM Compression Systems and "hammer tested" to insure that a good bond has been made. Alternatively, all below grade compression grounding systems must meet all UL467, CSA, IEEE837 test requirements and conform to the National Electrical Code Standards. The material at the connectors shall be pure wrought copper extrusions, rod and seamless tubing and be identical material to the conductor. Connectors must be of heavy duty design and be of range taking design to accept conductor ranges of #6 solid to 500 Kcmil plus 5/8" ground rods. Compression connectors need to be compressed with system engineered tooling which makes a circumferential or round crimp. Hex crimp is not acceptable due to sharp flashes and spurs that may occur. Each connector must be clearly marked with catalog number, conductor size and installation die information. Inspection ports must be provided on lug terminations and splices. The system must emboss all the appropriate die index numbers on all connectors after completion of the crimp. Connectors must be prefilled with penetrox copper type oxidation inhibitor and be individually sealed in clear polyethylene sheet to keep out dirt and contamination.
- E. Drive grounding electrodes as required. Where rock is encountered, grounding plates of copper, 1/4-in. x 24-in. x 24-in may be used in lieu of grounding rods. Plates must be installed at 36" minimum below finished grade.
- F. Connect grounding electrode conductor to building steel and metallic waterline per NEC 250-81. Allow a minimum of 25 feet of grounding conductor in foundation footing and make 3 connections to Rebar. Connections shall utilize an acceptable compression method with connectors listed for contact with respective metal types.
- G. Provide a grounding terminal pad in all panelboards, switchboards, and other electrical equipment.
- H. Directly ground to the work piece welding machines used in construction. The use of the building or equipment steel or conduits of any kind as a common ground point is not allowed under any conditions. Contractor is responsible for any electrical pieces of equipment damaged by not using the welder grounding method described above.
- I. Provide a green insulated grounding conductor in all conduit serving receptacles and/or equipment. Refer to panelboard schedules for sizing.
- J. Ground all receptacles to outlet box with a conductor.
- K. Flexible conduit will not be allowed as a grounding means.
- L. Install metallic fittings on clean contact surfaces to ensure electrical conductivity.
- M. Tighten connectors, terminals, screws and bolts, in accordance with manufacturer's published torque tightening values or comply with torque tightening values specified in UL 486A to assure permanent and effective grounding.

RESTROOM BUILDING

- N. Apply a corrosion-resistant finish to places where factory applied protective coatings have been damaged.
- O. Protect all exposed, grounding electrode conductors with Schedule 40 PVC nonmetallic conduit.
 - 1. Grounding electrode conductors shall not be protected with metallic materials.

3.02 GROUNDING ELECTRODE SYSTEM

- A. At each building's service or disconnecting means install a grounding electrode system which includes;
 - 1. A concrete encased electrode connected to the concrete reinforcing bars and;
 - 2. The building structural steel and;
 - 3. The building's metal underground (10 ft.) water pipe.
 - a. This connection must be within the first 5 ft. of the water pipe's entrance into the building. Water piping cannot be the sole ground and must be supplemented.
 - 4. Other electrodes such as a rod, plate or ring may be used to supplement but cannot be used as a substitute.
- B. At each grounded separately derived system install a grounding electrode conductor to connect the grounded (XO-neutral) conductor to;
 - 1. The nearest one of the following electrodes:
 - a. An effectively grounded structural steel member or;
 - b. An effectively grounded metal underground (10 ft.) water pipe.
 - 1) This connection must be within the first 5 ft. of the water pipe's entrance into the building.
 - 2. If neither of these is available, install a 3/0, copper, common grounding electrode conductor from the building's service or disconnecting means. Connect taps from this common grounding electrode conductor to the separately derived system's grounded (XO-neutral) conductor.

3.03 SYSTEM BONDING

- A. SERVICES
 - 1. Install a main bonding conductor between the service ground bus and the grounded (neutral) bus-bar.
- B. SEPARATELY DERIVED SYSTEMS
 - 1. Install a bonding jumper between the equipment ground bus and the separately derived electrical system's (transformer, UPS, central battery/inverter or generator) grounded (XO-neutral) bus.

RESTROOM BUILDING

3.04 ADDITIONAL BONDING

- A. Install 3/0 AWG bonding jumpers around all structural metal expansion joints.
- B. Each building's interior metal water piping system which does not qualify to be used as a grounding electrode shall be bonded to the building's service or disconnecting means.
- C. Bond the grounded (XO-neutral) conductor of each separately derived system to the nearest available point of the interior metal water piping system(s).
 - 1. When the structural steel is being used as the grounding electrode for the separately derived system the interior metal water piping system(s) may be bonded to the structural steel.
- D. Install bonding jumpers around raceway expansion joints.
- E. Install bonding jumpers around insulated water pipe joints.
- F. Install a bonding jumper between all grounding electrodes used for communications, radio and television or antenna systems and the building's grounding electrode system.

3.05 COMMUNICATION GROUNDING

- A. Provide a surface mounted, inter-system grounding bus-bar at the service equipment or a separate building's disconnecting equipment and in each communications room.
- B. At the service or separate building's disconnecting means, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the equipment ground bus.
- C. At communications rooms, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the building's structural steel.

3.06 EQUIPMENT GROUND

- A. Raceways shall not be used as the sole equipment ground.
- B. Bond the equipment grounding conductors to all boxes and enclosures.
- C. Each receptacle shall be bonded to its respective device box. The connection shall be made by means of a bonding jumper between the device and the box. Where the receptacle mounting yoke is designed and listed for the purpose of grounding; the bonding jumper may be omitted. This does not substitute for the need of grounding the outlet box.
- D. Each isolated ground receptacle shall have an isolated ground conductor installed complete from receptacle to the isolated ground bus in the panelboard. No other grounding connections shall be made to these receptacles, specifically connections to the device box or raceway system.

3.07 TESTING

- A. Following completion of installation, test system ground for continuity and test resistance to ground by "fall of potential" method and all feeders or sub-feeders with appropriate meggers, or other approved instruments and methods, to determine ground and insulation resistance values.

RESTROOM BUILDING

- B. Submit logs of values obtained, nameplate data of instruments used and instrument calibration data prior to final inspection. Instruments used are subject to acceptance.

END OF SECTION

SECTION 26 05 29 – HANGER & SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all required supporting devices, including but not limited to channels hangers, brackets, fittings, clamps, hardware, anchor bolts, rods, electrical accessories, etc., for conduit and equipment.

1.02 STANDARDS

- A. Conform with the latest requirements of the NEMA and The National Electric Code.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Support Channel: Hot-dipped galvanized steel, sized for load, minimum size 12 gauge, 1-5/8 wide by 13/16 deep. Furnish fasteners sufficiently sized to carry load imposed.
- B. Hardware: Corrosion Resistant (Hot-dipped galvanized all steel components)
- C. Support Wires (16 Ga. Minimum) and Tie Wires (22 Ga. Minimum) or as required by UL listed assemblies: Galvanized Steel
- D. Coatings: All steel components shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Perforated iron straps are not permitted for supporting conduits. Conduits run between the webs of bar joists may use galvanized tie wire for securing the conduits. Cut excess wire and bend ends to prevent sharp ends.
- B. Support horizontal and vertical conduit runs by one-hole straps, clamp-backs or other acceptable devices and suitable bolts. All conduits shall be secured to structure with supporting devices dedicated for the electrical system and/or conduits for systems furnished under the Electrical Contractor responsibilities. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers, equal to the Modern Co. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.
- C. All conduits shall be supported a maximum of ten feet (10') on center. Also, support conduits within twelve inches (12") of any bends, outlet boxes, wall penetrations or joints in pipe. All conduits shall be secured to structure. Lighting fixture whips may not be secured to ceiling tie wires. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines
- D. Conduits routed below bar joists shall utilize acceptable clamps.

RESTROOM BUILDING

- E. Fasten hanger rods, conduit clamps and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, or beam clamps. Do not use spring steel clips and clamps. Submit method of attachment for review prior to commencing work.
- F. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheetmetal screws in sheetmetal studs; and wood screws in wood construction.
- G. Do not fasten support wires to piping, ductwork, mechanical equipment or conduit.
- H. **Do not fasten conduit or junction boxes to ceiling grid wire. All conduit must be independently supported.**
- I. Support recessed fluorescent light fixtures with support wire at all four corners as required by roof/ceiling assembly. If roof/ceiling assembly does not require supports at each corner, support fixtures with minimum of two support wires at diagonally opposite corners. Spray paint ends of fixture support wires orange.
- J. Conduits, except as approved by NEC, shall not be used to support low voltage cables.
- K. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for conduit 2-1/2" and smaller. For conduit over 2-1/2", up to and including 4" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All conduit stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 3-1/2"). Provide supports for piping under 2" at six feet on center. Provide supports for conduit 2" and over at eight feet on center.
- L. Provide all angles, unistrut supports and threaded rods under any structural elements or mechanical equipment where required for proper placement and support of light fixtures and/or conduits.
- M. Supports and hangers shall be installed to permit free expansion and contraction in the raceway systems. Where necessary to control expansion and contraction, the raceways shall be guided and firmly anchored. Anchors shall be approved by the Engineer and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No conduit shall be self-supporting, nor shall it be supported from equipment connections. Transmission of vibrations, noise, etc., shall be considered and any special suspension with vibration dampers to minimize transmission shall be used where necessary.
- N. Where ducts interfere with the proper location of hangers, furnish and install trapeze hangers. Trapeze hangers may be used to support groups of conduit run in parallel.
- O. Install metal framing to support wall mounted equipment and wall or ceiling mounted raceways.
- P. Install expansion bolts to attach framing to concrete. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.
- Q. Touch up all scratches or cuts on steel components with an approved zinc chromate or a 90 percent zinc paint.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide a complete conduit system as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

Conform with the latest requirements of the NEMA, the National Electrical Code, and be UL listed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Rigid Metal Conduit (RMC): Hot-dip galvanized, threadable steel raceway, galvanized after fabrication. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.
- B. Intermediate Metal Conduit (IMC): Conduit shall be similar to rigid steel conduit except thinner wall. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.
- C. Electrical Metallic Tubing (EMT): EMT shall be made of hot-dip galvanized strip steel. Fittings shall be die cast compression or set screw type.
- D. PVC - Schedule 40 and Schedule 80 polyvinyl chloride conduit (PVC Duct) shall be UL rated. Conduit fittings and cement shall be produced by the same manufacturer and approved for such use.
- E. Flexible Metal Conduit (FMC): Spirally wound continuously interlocked zinc coated strip steel. Fittings shall be die cast zinc, either screw-in or squeeze type.
- F. Flexible Conduit (LFMC): Liquid-tight (vibration and/or wet areas) fabricate from continuous lengths of spirally wound galvanized steel strip interlocked with a gray polyvinyl chloride cover extruded over the core to make the conduit liquid tight, oil proof and bendable to a small radius. Fittings shall be compression type, die cast zinc, with insulated throat.
- G. Metal-Clad Cable (MC): Galvanized interlocking steel armor. 600 volt, type THHN/THWN, integrally colored insulation. Size #12 AWG or #10 AWG, copper conductors. Fittings shall be listed for MC usage and include anti-short bushings. Reference Section 3.03 for acceptable uses.
- H. Metal Wire-ways.
 - 1. Furnish with wire retainers on not less than 12 inch centers. All screws installed towards the inside shall be protected to prevent possible wire insulation damage.
 - 2. The finish shall be the manufacturers' standard color and shall consist of not less than two coats of enamel over a rust-inhibiting prime coat.
- I. Surface Metal Raceway (2000 series).
 - 1. Surface metal raceway shall consist of a single compartment base, blank cover, and appropriate fittings to complete the installation per the electrical drawings.

RESTROOM BUILDING

2. The base and cover shall be manufactured of steel and finished with a white color.
 3. Approximately $\frac{3}{4}$ " deep, $1\frac{1}{4}$ " high and 5' sections.
- J. Non-Metallic Multi-outlet Assemblies (5400 series).
1. Surface raceway system shall consist of a dual compartment raceway base, twin cover, appropriate fittings, outlets and device mounting plates necessary for a complete installation.
 2. Duplex receptacles and data outlets ("activate connectivity inserts") mounted at 24" centers or as noted on plans. Connect adjacent receptacles on alternate circuits.
 3. Approximately $1\frac{3}{4}$ " deep, $5\frac{1}{4}$ " high and 8' sections with equal compartments.
 4. The finish shall be white color and shall consist of not less than one coat of enamel over a prime coat.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Raceway and cable usage and installation shall conform to the appropriate article of the National Electrical Code (NEC), as a minimum.
- B. Do not install conduit that is crushed or deformed in any way.
- C. Provide a nonmetallic (nylon, polypropylene, or approved equal) drag line of suitable strength in spare conduits and telephone conduits. Tightly plug spare conduits at both ends.
- D. Do not pull wire into conduit system until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed.
- E. No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors.
- F. No wiring system of any type shall be installed in any shaft containing ducts used for vapor removal or for ventilation of commercial-type cooking equipment.
- G. Fasten and support the wiring method employed to the permanent structure using listed straps with corrosion resistant hangers and fasteners.
- H. Ceiling system wires or lay-in type ceiling grid components shall not be used as a means of support.
 1. Independent support wires and associated fittings which are installed in addition to the ceiling system support wires, shall be permitted: (300.11.A)
 2. Independent wires within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall be distinguishable by color. (300.11.A.1)
 3. Independent support wires that provide support for device boxes shall be secured at both ends. (300.11.A).

RESTROOM BUILDING

- I. Bends shall be made with factory elbows or field bent. Field bends shall be made using equipment designed for the particular raceway material and size. Bends shall be free from dents or flattening.
- J. Conduit bodies may be used in lieu of conduit elbows where covers will be accessible and ease of installation and appearance warrants their use.
- K. Install expansion-deflection fittings where raceways cross structural expansion joints or where required to compensate for thermal expansion and contraction. Install bonding jumpers across expansion-deflection fittings in metal raceway systems.
- L. Openings through fire-resistant-rated or sound-resistant-rated walls, partitions, floors or ceilings shall be fire-stopped by installing raceways or cables through sleeves set through the walls, partitions, floors or ceilings and fire-sealing all openings and voids around the sleeves, raceways and cables.
- M. Do not drill or pierce structural steel members under any circumstances without the Engineer's specific approval.
- N. Minimize roof penetrations by routing conduit through the equipment roof opening. If roof penetration is necessary, coordinate with the Architectural Specifications and penetrate as directly below the equipment disconnect or wiring connection point as possible. Do not use flexible conduit in a pitch pan.
- O. Arrange all conduits to drain away from the building.
- P. Perform all necessary excavation and backfilling. Tamp backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. Provide shoring, bracing, and de-watering as necessary. Remove all excess and materials not suitable for backfill from the site. Provide barricades to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.
- Q. A tracer tape wire shall be installed in all trenches which do not contain conductive conductors within them. This will include future use raceways, optical fiber, etc.
- R. Raceway systems shall be complete before installing conductors.
- S. The interior of all raceways shall be cleaned before installing conductors.
- T. Terminate future use raceways with a capped coupling within an accessible area.
- U. Workmanlike manner: Type MC cable shall be installed in a neat and workmanlike manner. Cable shall not cross other cable or have excess slack. Cable that is installed vertically, must be plumb with the vertical framing of the structure.
- V. Bundling of cable is limited to three cables for each support ring.
- W. Type MC cable may be only supported by fasteners or clamps that are approved and UL tested for cable support.

3.02 INSTALLATION BELOW GRADE

- A. Minimum size raceway is 3/4 inch.

RESTROOM BUILDING

- B. Provide rigid galvanized steel conduit or PVC where conduits are installed in concrete floor slab $\frac{3}{4}$ " maximum. Maintain proper concrete coverage as directed by structural engineer. PVC conduit shall not penetrate slab above finished grade.
- C. Provide rigid galvanized steel or PVC conduit where conduits are installed below grade.
- D. Swab clean all conduits before cable installation. Waterproof all conduit joints after cable installation.
- E. Provide conduit wall sleeves for all conduits penetrating walls, grade beams, etc. and other locations shown on the Drawings.
- F. Where required to bend PVC ducts to satisfy indicated routing, preform ducts to allow ends of duct sections to be in a straight alignment. Accomplish preforming of ducts by utilizing proper duct heater units.
- G. Perform all necessary excavation and backfilling for proper installation of work. Take precautions not to excavate below depth required. Backfill trenches with sand, 3" below conduits and 3" above. Tamp remainder of backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. In areas to be paved, compact to density to receive pavement. Where pavement is broken for the installation of conduit, repair to original condition. Provide shoring, bracing, and de-watering if necessary for installation of work. Remove from site all materials encountered which are not suitable for backfill.
- H. When and if damage is caused to underground utility lines or structures, above ground utility lines or structures, or other purposeful surface conditions, either on or off the right-of-way, make immediate temporary repairs. At the first opportunity, make permanent repairs which are acceptable to the Owner. All such repairs shall be made at the Contractor's expense.
- I. Where necessary, provide barricades around open excavations to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.
- J. Where conduits embedded in concrete floor or roof deck cross expansion joints, they shall be joined together using O.Z. Gedney type DX expansion fittings and bonding jumpers. Straight runs of conduit over 150' long shall have O.Z. Gedney Type AX expansion fittings installed to minimize movement. Fittings shall be installed at a maximum of 150' on center.
- K. Where horizontal runs of conduit transition to vertical and continue above finished grade or finished floor; the transition shall be made with a 90 degree long radius sweep. The sweep may be PVC (2" and smaller) and shall be RGS (2-1/2" and larger). No PVC conduit will be allowed above finished grade or finished floor.
- L. **CONDUITS RUN BELOW FINISHED FLOOR SHALL NOT PENETRATE GRADE BEAMS. UNLESS APPROVED BY STRUCTURAL ENGINEER.**

3.03 PERMITTED RACEWAY USAGE:

- A. Raceway transitions at all locations;
 - 1. Rigid nonmetallic conduit runs from below grade level shall transition to galvanized rigid steel or intermediate steel conduit, wrapped with corrosion protection tape, prior to exiting at grade level and continue thereafter in accordance with their usage requirements.
 - a. Caulk concrete-to-conduit joints with a silicone rubber compound.

RESTROOM BUILDING

2. Continue the more protective conduit type into an area where a less protective conduit type is permitted for a distance of not less than 1 foot.
- B. Electrical metallic tubing at;
1. Interior locations when;
 - a. Concealed within walls and ceilings or; **do not use in the mortar filled cells of concrete masonry units.**
 - b. Exposed and more than 8 feet above finished floor or;
 - c. Exposed and more than 3 feet above finished floor in electrical or mechanical rooms or;
 - d. Exposed and more than 1 foot above a finished attic or mezzanine floor.
 - e. Do not use where exposed to standing water or other continuously damp or wet areas.
 2. Exterior locations when;
 - a. More than 10 feet above the finished ground surface or;
 - b. More than 1 foot above the finished ground surface within a lockable equipment yard or;
 - c. In the crawl space below a building with the 1st level elevated.
- C. Rigid or intermediate metal conduit at;
1. Interior locations when;
 - a. Exposed, in other than electrical or mechanical rooms, and installed less than 8 feet above finished floor or;
 - b. Exposed in electrical or mechanical rooms and installed less than 3 feet above finished floor or;
 - c. Exposed and less than 1 foot above a finished attic floor or mezzanine floor.
 2. Exterior locations when;
 - a. Less than 10 feet above the finished ground surface or;
 - b. Less than 1 foot above the finished ground surface within a lockable equipment yard.
 - 1) Malleable iron straps will be required at these locations.
- D. Rigid metal and intermediate metal conduit wrapped with corrosion protection tape or rigid nonmetallic conduit at;
1. Underground locations with a ¾" minimum size when;

RESTROOM BUILDING

- a. Located outside of the building line or;
 - b. Located below a concrete slab on grade or;
 - c. Located below a beam of a slab on grade or.
 - d. Located within a concrete slab on grade where the outside diameter is equal to or less than 20 percent of the slab thickness.
 - 1) Seal conduit ends at each building entry.
- 2. Below grade;
 - a. The minimum size shall be 3/4 inch.
 - b. Seal conduit ends at each building entry.
 - c. Coordinate covering with Structural Engineer.
- E. Rigid nonmetallic conduit for;
 - 1. An exposed grounding electrode or bonding conductor below 10 ft. to guard from physical damage.
- F. Flexible metal conduit in;
 - 1. Dry interior locations with a minimum length of 2 feet and maximum length of 6 feet to;
 - a. The final connection of transformers, motors and vibrating equipment.
- G. Flexible metal conduit or metal-clad cable for light fixtures or ceiling mounted devices.
 - 1. Dry or damp interior locations with a maximum length of 6 feet to;
 - a. The final connection of light fixtures; or
 - b. The final connection of ceiling mounted outlet boxes or.
- H. Flexible metal conduit is not allowed for any technology rough-in, must be EMT.
- I. Flexible metal conduit or metal-clad cable with the following limitations for receptacles and branch circuit.
 - 1. Dry interior locations;
 - 2. Feeds one outlet only;
 - 3. 20 amp maximum;
 - 4. Both segment ends are located within the same room.
 - a. One segment end at the outlet box and the other segment end at a ceiling junction box located, within 10 feet of the entrance into the wall cavity, vertically above the outlet served.

RESTROOM BUILDING

5. Where installed in an insulated wall, the cable must be on the conditioned side of the insulation and;
 6. Each cable or conduit shall be supplied by only one (1) branch circuit breaker (one, two or three poles).
 7. No MC to be horizontal in wall. All horizontal runs must be pipe and wire only.
- J. Liquid-tight flexible metal conduit in;
1. All locations with a minimum length of 2 feet and maximum length of 6 feet for;
 - a. The final connection of all liquid pump motors and associated control connections or;
 2. Damp or wet interior and all exterior locations with a minimum length of 2 feet and maximum length of 6 feet to;
 - a. The final connection of transformers, motors, and vibrating equipment.

END OF SECTION

SECTION 26 05 34 - OUTLET BOXES, PULL BOXES AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide outlet boxes in accordance with the National Electrical Code at locations shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide standard hot-dipped galvanized pressed steel boxes, minimum 4"x4" by 1-1/2" deep. Use 4 11/16" by 2 1/8" deep box when using 1" conduit.**
- B. Cabinets with screw covers or as specifically noted for junction or pull boxes larger than 150 cubic inches.
- C. All junction, pull and splice boxes to conform to NEC Article 370.
- D. All metallic boxes are to have an internal means of grounding.
- E. Flush mounted wall and finished ceiling boxes.
 - 1. Within framed, drywall, plastered or tile covered walls, with 3/4" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover and a far-side support.
 - 2. Within drywall or plaster covered or suspended ceilings, with 3/4" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover.
 - 3. Within masonry walls, with 3/4" max. raceway, furnish galvanized steel boxes, minimum 2-1/2-inch deep.
- F. Surface mounted boxes.
 - 1. Mounted at or below 10' above the finished surface, 3/4" max. raceway size, furnish cast aluminum boxes with a surface mounted cover.
- G. Junction and Pullboxes.
 - 1. Furnish, minimum 4" square, 1 – 1/2" deep, galvanized steel junction and pullboxes where installation conditions warrants their use. Boxes shall be furnished with screw-on covers or hinged covers. Covers shall be such that it can easily be handled by one person. All hardware and fasteners shall be galvanized steel.
- H. Flush mounted floor boxes.
 - 1. Furnish adjustable, concrete tight, corrosion resistant, duplex type. Compartmental type for combination receptacle and communication. The coverplate shall be brass with hinged flap and carpet flanges. The minimum below ground/slab conduit size shall be 3/4".

RESTROOM BUILDING

- I. Underground boxes.
 - 1. U. L. listed.
 - 2. Pre-cast, polymer concrete.
 - 3. Minimum size of 10" W X 10" L X 10" H.
 - 4. Bolt down cover.
 - 5. Stainless steel hex-bolts and replaceable nuts.
 - 6. Minimum load rating of 5,000 lbs. (select by location)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Through wall boxes and boxes mounted back-to-back are not permitted. Provide 8 inch minimum separation in order to minimize sound transmission.
- B. Set flush with wall or ceiling finish in accordance with N.E.C., Article 370. Extension sleeves are not permitted for boxes improperly set.
- C. Verify location of outlets prior to rough-in. When necessary, relocate outlets to avoid interference with other work or equipment. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers.
- D. Where more than one (1) switch or device is located at one (1) point, unless otherwise indicated, provide gang boxes and covers. When the voltage between switches exceeds 300 volts, provide barrier partitions between adjacent switches located in the same box. Sectional switch boxes or utility boxes not permitted.
- E. Provide pressed steel boxes for all interior work. Provide square boxes with plaster rings. Provide appropriate size multi gang box for group devices. Single gang boxes screwed together is not acceptable.
- F. Where boxes are installed in masonry walls, use only approved masonry type boxes for single gang and multi-ganged applications. Standard 4" square boxes with plaster rings are not allowed. Caulk around joint between receptacle box and masonry. Verify color with architect.
- G. Do not drill and pierce structural concrete members and structural steel without prior approval of the Engineer.
- H. Mount all boxes plumb.
- I. Mount boxes completely rigid without conduit or finished wall support.
- J. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging, and/or straps as required to make the outlet completely rigid. Support boxes with "caddy screw gun brackets", "caddy box mounting bracket", "caddy quick mount box brackets" or acceptable alternates.

RESTROOM BUILDING

- K. **Dimensions are from finished floor to centerline of outlets.** Adjust heights of outlets in masonry walls from that indicated so that receptacles are not lower than 16" A.F.F. and switches are not higher than 48" A.F.F. Outlet height so adjusted shall be consistent. Unless otherwise indicated, mount outlets at the following heights:

Wall switches/Wall Phone	4 ft. - 0 in.
General Duplex receptacles	1 ft. - 6 in.
Receptacles at Millwork	verify with millwork
Receptacle for Refrigerators	2' – 6"
Weatherproof duplex receptacles	1 ft. - 6 in.
Telephone/Data outlets/Teacher Station	1 ft. - 6 in.
Telephone/Data at millwork	verify with millwork
Garages/Apparatus Bay receptacles	2 ft. - 0 in.
Clocks	8 ft – 0 in
Access Point Data Drops (wall mounted)	10 ft – 0 in

- L. For boxes installed above ceilings, label the box cover with the circuit numbers installed. Labeling shall be with a permanent, black marker with broad tip.
- M. Boxes installed in rated walls shall have a minimum horizontal separation of 24". Maximum surface area of boxes shall not exceed 16 square inches.
- N. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required for bottom covering. Adjust covers flush with finished floor.
- O. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall.
- P. Install recessed boxes flush to the finished wall or ceiling line by the use of manufactured tile rings to extend the box forward.
- Q. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.
- R. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture.
- S. Install knockout closures to cap all unused openings.
- T. All boxes shall be installed with coverplates.
- U. Install boxes as required to facilitate conductor installation in raceway systems. Junction and pull boxes shall be sized to accommodate conductors, splices, devices and fittings.

RESTROOM BUILDING

- V. Raceways are NOT allowed to terminate to extension rings.
- W. Install boxes so that covers are accessible and easily removable after completion of the installation. The minimum clear space in the direction of the box opening shall be 36".
- X. Include suitable access doors, with the proper fire rating, for boxes above inaccessible ceilings. Boxes shall be located within reach of the access.
- Y. Install underground boxes with cover slightly above finished grade.
- Z. **Spray paint J-Boxes red for Fire Alarm Systems. All other special system J-Boxes to be painted white.**

END OF SECTION

SECTION 26 05 80 - EMPTY RACEWAY ROUGH-IN

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install all equipment, accessories and material required for the rough-in of empty raceway systems in accordance with the specifications and drawings.
- B. Rough-in raceway sections for indicated devices and outlets in all walls, floors and underground sufficient to facilitate installation of the following systems without cutting or otherwise damaging walls, ceilings or floors installed in this contract:
 - 1. Communications
 - 2. Fire Alarm
 - 3. Television
 - 4. Data
 - 5. Security
 - 6. Controls
- C. **ALL CONDUITS SHALL HAVE A PULL CORD INSTALLED. INSTALL BLANK COVERS ON ALL UNUSED JUNCTION BOXES.**
- D. 3/4" CONDUIT MINIMUM.
- E. Electrical Contractor shall provide all conduit, junction boxes and outlet boxes for HVAC controls as specified in Section 26 05 00, 1.03, D. Coordinate locations and requirements with Mechanical Contractor and Controls Contractor prior to rough-in. Provide outlet box for sensor and conduit to above accessible ceiling. Provide conduit for all wiring in areas with no ceiling. Provide conduit from outdoor units to above accessible ceilings. Provide conduit between make-up air units and associated condensing units.
- F. **REFERENCE TECHNOLOGY DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS CONCERNING CONDUIT ROUGH-IN FOR VOICE/DATA SYSTEMS.**
- G. Floor mounted devices: Provide pathway to nearest accessible ceiling for all floor mounted devices called for in this specification.

1.02 QUALITY ASSURANCE

- A. Construct each item of equipment, including parts and accessories, in a workmanlike manner, using new materials or the best quality obtainable for the purpose intended. Design and build materials in accordance with the best practices of the electrical industry.
- B. Comply with all requirements of serving utility.

PART 2 - EXECUTION

2.01 INSTALLATION

- A. Interior conduit systems shall have runs less than 100 feet from point to point.
- B. Provide accessible pull boxes when necessary. Provide blank covers for all outlet boxes, unless otherwise noted.
- C. All bends for telephone and cable television service shall be 36 inch radius, minimum.
- D. Provide outlet box in wall at 18" A.F.F. (UON) and conduit with string to above accessible ceiling location. Provide insulated bushing on end of conduits.
- E. **Provide one (1) additional outlet boxes and conduit with pull cord to above the ceiling. Final location shall be as directed by the Architect. Outlets can be added at any phase of construction with the exception of finished CMU walls.**

END OF SECTION

SECTION 26 24 16 - BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide branch circuit panelboards as shown on the Drawings and as herein specified.
- B. Panelboard feeders are sized from the "Panelboard Connection Schedule". When a panel is fed from a transformer use the "Transformer Connection Schedule" for feeder size. When there is a conflict between the sizes, use the largest of the two.
- C. This section specifies the furnishing and installation of molded case, thermal-magnetic circuit breakers. Electronic, solid-state trip circuit breakers are NOT allowed.
- D. Maximum circuits per panelboard section shall be 42 circuits.

1.02 STANDARDS

- A. Provide U.L. label.
- B. Comply with applicable standards of NEMA and the NEC.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D/Schneider Electric
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse/Eaton
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for each branch circuit panelboard.
- B. Submit shop drawings for each panelboard which include outline and support points, dimensions, voltage, main bus ampacity, short circuit ampere interrupting rating, circuit breaker arrangement, sizes and number of poles. Shop drawing shall list all spaces and circuit breakers to be installed in each panelboard.
- C. Provide shop submittal which includes the following:
 - 1. Cabinet
 - a. Housing
 - b. Trim
 - c. Outline dimensions
 - d. Available spaces
 - e. Panelboard mounting

RESTROOM BUILDING

2. Circuit breakers
 - a. Frame size
 - b. Trip setting
 - c. Class
 - d. Interrupting rating in RMS Symmetrical amperes
 - e. Mounting
 - f. Voltage rating
 3. Busing
 - a. Ampere rating
 - b. Material
 - c. Incoming cable lug size
 - d. Bus bracing
 4. Manufacturer's catalog numbers.
 5. Other descriptive data as may be required.
- D. Circuit breaker arrangement must be identical to the schedules or one line diagram unless there is a technical reason for deviation. All reasons for deviation must be stated on the shop drawings.**
- E. Unless specifically noted, only Max 42 circuits per section will be allowed.**

PART 2 - PRODUCTS

2.01 GENERAL.

- A. All new panelboards and switchboards on this project shall be by the same manufacture. The manufacture shall be the same as the manufacturer of the circuit breakers.
- B. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trims shall have pre-formed covers for unused mounting space.
- C. Interior leveling provisions shall be provided for flush mounted applications.
- D. Panelboards shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- F. Furnish suitable lugs for each conductor requiring a connection.

RESTROOM BUILDING

2.02 BUS CONSTRUCTION

- A. Fabricate all buses of 98 percent IACS conductivity, copper. Size buses to limit their temperature rise within the panelboard to 65°C based on a 40°C ambient temperature.
- B. Provide one continuous, un-reduced in size, bus bar per phase with “distributed phase” or “phase sequence” type connections to the branch circuit breakers. Extend the buses the height of the panelboard.
- C. Provide circuit breaker connections to the bus by means of a bolt. Square D “I-Line” may be provided.
- D. Insulate each individual phase bus to withstand 2000 volts a-c for 1 minute.
- E. Support the bus systems using non-carbonizing, non-tracking insulators.
- F. Furnish fully equipped spaces, include all appropriate connectors or mounting hardware.
- G. Furnish an insulated neutral bus which is the same size as the phase buses. Larger sizes may be required by the schedules or one line diagram.
- H. Furnish a solidly bonded equipment ground bus. Include terminals for feeder and branch circuit grounding conductors.
- I. Furnish an isolated ground bus, with terminals, where scheduled or noted on the drawings.
- J. Provide full size or larger insulated neutral bus bar. Where specified on the panel schedule, provide 200% rated neutral bus bar. Coordinate with plans.

2.03 RATINGS

- A. Panelboards and circuit breakers shall be rated for 60 hertz and have a voltage and current rating as indicated on the drawings or schedules.
- B. The finished panelboard assembly shall be fully rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault currents indicated on the drawings or schedules. The minimum rating for a 240 volt a-c panelboard shall be rated 10,000 AIC RMS symmetrical and a 480 volt a-c panelboard shall be rated 14,000 AIC RMS symmetrical minimum. Series ratings are not permitted.
- C. **Final AIC ratings for all panels shall be determined and provided by the gear manufacturer to meet minimum allowable fault current from utility company transformer. Provide coordination study and fault current analysis as required for justification of sizes. Make all changes required by coordination study and include in bid price. Coordination study must be completed prior to submitting gear.**

2.04 ENCLOSURES

- A. Enclosures shall be at least 20 inches wide and made from galvanized steel with welded interior mounting studs. Provide gutter space in accordance with the National Electrical Code. Where conductors are carried through a box, the box shall be sized to include the additional space. Enclosures shall be fully enclosed.
- B. **ALL MULTI-SECTION PANEL ENCLOSURES SHALL BE THE SAME HEIGHT.**

RESTROOM BUILDING

2.05 HINGED FRONT COVER

- A. Mounting shall be flush or surface as indicated on associated schedules or drawings. Surface trims shall be the same height and width as the box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
- B. Fronts shall be of the concealed hinged type. Front shall not be removable with the door closed.
- C. Doors on front shall have rounded corners; edges shall be free of burrs. Doors shall have a flat latch type lock with a catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One key shall be provided with each lock.
- D. Furnish a nameplate, circuit directory frame, card and a clear plastic covering on the inside of the door. All loads shall be identified as specified in Section 16075.

2.06 FINISH

- A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray paint applied.
- B. Nema 3R enclosures shall be properly cleaned, primed, and a finish coat of gray paint applied.
- C. Supply one quart of finish paint for each project. Touch-up after installation.

2.07 MOLDED CASE THERMAL-MAGNETIC CIRCUIT BREAKERS

- A. Furnish molded case, thermal-magnetic circuit breakers in lighting / appliance and power distribution panelboards for the specified service with the number of poles and ampere ratings indicated on the schedule or drawings. Incorporate inverse time characteristic by bi-metallic overload elements and an instantaneous characteristic by magnetic trip.
- B. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
- D. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breakers shall be clearly marked ON and OFF.
- E. Circuit breakers shall be factory sealed.
- F. All circuit breakers shall be suitable for mounting in any position.
- G. Circuit breakers shall be equipped with factory installed mechanical lugs.
- H. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- I. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

RESTROOM BUILDING

- J. For 2-pole and 3-pole breakers, use the common-trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable except where multiple single breakers are used to serve modular furniture.
- K. Where indicated, provide ground fault (GFCB) or shunt trip breakers.

2.08 LISTING

- A. The completed panelboard shall be UL listed.
- B. Certification standards, with applicable voltage systems and corresponding interrupting ratings, shall be clearly marked on the face of each circuit breaker.
- C. Circuit breakers shall be equipped with listed electrical accessories as noted on the schedules or drawing.
- D. When required, circuit breakers shall be listed as HACR type.
- E. When required, circuit breakers shall be listed as Switch Duty type.
- F. When required or indicated on the drawings or schedules, equipment shall be listed for the environment in which it is installed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install box, trim and interior rigid and plumb. Center interior with opening.
- B. Install panelboards in accordance with the instructions of the manufacturer and as shown on the Drawing. Install complete with all required electrical connections.
- C. Unless otherwise noted, install panelboards with the top of the trim 6 ft. 0 in. above finished floor.
- D. Field check panelboard loading and reconnect circuits as required to provide balanced phase and line loads.
- E. Neatly bundle, route and support cables installed in wiring gutters of panelboards. Minimum bending radii as recommended by the wire and cable manufacturer.
- F. Install five (5) 3/4" conduits from top of flush mounted panelboards to accessible void above ceiling. Cap end of conduits above ceiling.
- G. All recessed panels are to be installed in 6" minimum wall thickness. Coordinate clear dimensions with Architect and General Contractor prior to rough-in.
- H. Provide wood trim for any semi-recessed panels, including panelboards. Coordinate with General Contractor and verify finishes with the Owner/Architect.
- I. Install filler blanks for any unused breaker space.
- J. All panel interior to be free of debris and dirt prior to installing panel covers.
- K. Check bolted and circuit breaker connections using a torque wrench.

RESTROOM BUILDING

- L. The faces of all circuit breakers shall be flush with each other.
- M. Affix permanent and individual circuit numbers to each circuit breaker in a uniform position.

END OF SECTION

SECTION 26 27 26 - DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide switches and receptacles as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

- A. Provide all receptacles which conform with NEMA standards for amperage and voltage classification.
- B. Provide devices U.L. listed for the application and for the type of wire used.

1.03 ACCEPTABLE MANUFACTURERS

- A. Leviton, or approved equal

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for each device.
- B. Provide shop submittals which include the following information:
 - 1. Manufacturer and catalog number.
 - 2. NEMA configuration.
 - 3. Voltage and amperage ratings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Straight Blade Receptacles: Furnish Leviton receptacles or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
 - 1. Single receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 - 2. Single receptacle, 20 amp, 250-volt, 2-pole, 3-wire, grounding, NEMA 6-20R.
 - 3. Duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 - 4. Tamper resistant, duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
- B. Toggle Switches: Furnish Leviton switches or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
 - 1. Single pole, single throw, 20 amp, 120/277 volt.
 - 2. Single pole, double throw, momentary, 20 amp, 120/277 volt.

RESTROOM BUILDING

3. Single pole, double throw, maintained, 20 amp, 120/277 volt.
 4. Double pole, single throw, 20 amp, 120/277 volt.
 5. Three way, single throw, 20 amp, 120/277 volt.
 6. Four way, single throw, 20 amp, 120/277 volt.
- C. Locking Switches: Furnish Leviton switches with #55500 key, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
1. Single pole, single throw, 20 amp, 120/277 volt.
 2. Single pole, double throw, momentary, 20 amp, 120/277 volt.
 3. Single pole, double throw, maintained, 20 amp, 120/277 volt.
 4. Double pole, single throw, 20 amp, 120/277 volt.
 5. Three way, single throw, 20 amp, 120/277 volt.
 6. Four way, single throw, 20 amp, 120/277 volt.
- D. Dimmer Switches: Furnish Lutron NT series, or equivalent, continuously adjustable slide dimmer with preset on/off switch. Dimmer shall be solid-state type for use with 120-volt incandescent lamps and shall have electromagnetic filters to eliminate noise, RF and TV interference. Dimmer wattage is indicated on the drawings or 1000 watt minimum.
- E. Ground Fault Devices: Color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
1. Ground fault circuit interrupter (GFCI), 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 2. Ground fault feed through switch, 20 amp, 125-volt.
- F. Device Plates:
1. Unless otherwise indicated, provide smooth metal device plates of Type 430 stainless steel for all indoor devices. Verify color with architect prior to ordering. Cover plates for devices served by emergency circuits shall be red.
 2. Provide telephone and data outlets with blank metal type 430 stainless steel covers.
 3. Provide properly gasketed vertical single lift device plate of aluminum die cast for weatherproof receptacles and/or switches.
- G. Floor Outlets:
1. Provide where shown on the drawings, PVC rectangular floor boxes. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.
 2. Receptacle floor outlets specified as duplex shall have duplex screw cap coverplates. Telephone and/or data floor outlet boxes to have combination screw cap coverplate.

RESTROOM BUILDING

- 3. Provide brass carpet flanges for each floor box installed in carpeted areas.
- 4. Multiple device locations shall incorporate two (2) or three (3) gang outlet box.
- H. Provide GFI receptacles within 6 feet of any sink, lavatory, wet area and outdoors. All GFI resets to be located in the same room protected.
- I. Provide GFI protection for all receptacles in areas where power hand tools or portable lights are used (shop areas, garages, etc.).
- J. Provide GFI protection for all circuits used for heat tracing.
- K. Provide a receptacle in all mechanical/electrical rooms.
- L. Surge Arresting Receptacles: Where surge arresting receptacles are indicated, provide receptacles meeting Federal Specification WC-596F which are UL listed (UL 1449 and UL 498) with integral surge suppression. Provide with audible surge protection failure alarm and replaceable surge arrester module. Eagle Electric "Super Spec SurgeBloc" or acceptable equal.
- M. All 120volt/20amp receptacles in kitchen area to be GFCI protected.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wiring devices of the type as indicated on drawings. Make up all connections tight and set device plumb. Use care in installing device in order to prevent damage to the device and the wire in the outlet box.
- B. Device Plates: Provide a device plate for each outlet to suit the device installed and install blank plates or covers for junction boxes and empty outlets, including telephone, computer, etc.
- C. Mount duplex receptacles vertically with grounding opening up unless otherwise noted.
- D. Prior to installation of outlets other than 20A, 120 Volts, verify receptacle type with Owner through Architect. Receptacles not verified shall be changed at Electrical Contractor's expense if necessary to operate equipment.
- E. Install all switches that are required to be handicap accessible at proper height per latest ADA Standards.
- F. Install wall switches vertically in an outlet box on the strike side of the door as finally hung.
- G. Install single throw switches so up is the ON position.
- H. Locking switches shall be furnished in corridors, common areas and any area with HID lighting. Contractor shall confirm exact location of all locking switches with the Architect/Engineer prior to rough-in.
- I. Provide "Caddy Screw Gun Bracket" between wall studs, as required to install switches, thermostats, intercom devices, etc. Verify exact location of devices prior to rough-in. Device boxes shall be aligned on center line of each box.

RESTROOM BUILDING

- J. Receptacles installed for electric water coolers shall be mounted at a height so as not to be visible after installation of EWC. Coordinate with equipment being provided.
- K. Provide one (1) duplex GFI/weatherproof receptacle within 25 feet of all mechanical equipment, located on the roof, on mezzanines, or on the ground. Connect receptacles to nearest available circuit with not more than 6 receptacles or home run to the nearest available panelboard and provide breaker as required.
- L. Engrave coverplates, designated for engraving, with 1/8 inch-high contrasting lettering.
- M. Engrave the coverplates of wall switches that control equipment which is not in sight of the switch with the designation of the equipment being controlled. Lettering shall be 1/8 inch high and of a contrasting color.
- N. All receptacles located above counter tops with sinks and receptacles in kitchens shall be GFI Type.
- O. Provide two (2) additional receptacles in base bid including wire, conduit, breakers and appurtenances. Each receptacle represents a dedicated circuit. Estimate length of circuit is 150 feet. Final location as directed by Architect.**
- P. Provide unit price to add additional receptacles over base bid. Use same lengths indicated above.**

END OF SECTION

SECTION 26 28 10 - MANUAL MOTOR STARTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide and install manual motor starters per NEC and as hereinafter specified.

1.02 STANDARD

- A. UL Listed.
- B. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. Cutler Hammer/Westinghouse
- C. ITE Siemens
- D. General Electric

1.04 SUBMITTALS

- A. Provide data sheets that include equipment voltage/current rating, catalog numbers, horsepower rating and other such descriptive data which may be required.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

- A. All manual motor starter switches shall consist of toggle operated two (2) or three (3) pole switches mounted in a NEMA 1 general purpose enclosure unless exposed to outdoor conditions; then mount in NEMA 3R enclosure.
- B. Contacts shall be double break silver alloy.
- C. Terminals shall be supplied, clearly marked and accessible from front of switch.
- D. Switch shall be equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and inter-changeable. Starter shall be inoperative if thermal unit is removed.
- E. Toggle switch shall be furnished with a handle guard.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount switches in accordance with NEC and all local codes. Provide all mounting materials and hardware.

RESTROOM BUILDING

- B. Confirm with Mechanical and/or Plumbing Contractor prior to mounting switch on respective equipment.

END OF SECTION

SECTION 26 28 15 - SAFETY DISCONNECT SWITCH

PART 1 - GENERAL

1.01 SCOPE OR WORK

- A. Provide safety switches for all pieces of equipment per NEC as indicated on the Drawings and specifications or as required.
- B. All safety switches are to be FUSED unless noted otherwise.**

1.02 STANDARDS

- A. Conform to U.L. listed and the latest NEMA standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for safety disconnect switches.
- B. Provide shop submittals which include the following information:
 - 1. NEMA type
 - 2. Enclosure type
 - 3. Ampere rating

PART 2 - PRODUCTS

2.01 CONSTRUCTION

- A. Provide safety switches appropriately rated for use with electrical system 600 Vac for 480 volts, 250 Vac for 208 volts and etc.
- B. Provide safety switches NEMA Standard KS1 for type HD (heavy duty), and horsepower rated for A/C motors.
- C. Switches requiring fuses and rated 600 amps and below shall be provided with rejection clips. Switches rated larger than 600 amps shall have Class "L" fuse connections provided.
- D. Provide safety switches in NEMA 1 enclosure located on the interior dry locations. Provide safety switches in NEMA 3R enclosure located on the exterior of the building or in wet locations.

RESTROOM BUILDING

- E. Provide quick-make and quick-break operating handle. Provide mechanisms which are an integral part of the box. Furnish a handle suitable for padlocking in the ON and OFF positions with a padlock of 5/16-inch diameter shank.
- F. Door Interlock. Furnish a door interlock to prevent opening the door when the switch is in the ON position, unless bypassed, and to prevent turning the switch ON when the door is open.
- G. Bypass Interlock. Furnish an external means to bypass the door interlock.
- H. Terminal Shield. Furnish incoming line terminals with an insulated shield so that live parts are not exposed when the door is open.
- I. Neutral. Where neutrals are indicated furnish switches with an isolated, fully rated neutral block. Make provisions for bonding the block to switch enclosure.
- J. Equipment Grounding. Furnish an equipment grounding kit.
- K. Fuse Holders. Where fusible switches are indicated, furnish switches with rejection-type fuse holders and fuses conforming to Section 16490, Fuses - 600 Volt and Below.
- L. Auxiliary Contacts. Where switches are shown for elevator service, furnish switches with two DPST auxiliary contacts.
- M. Provide lugs U.L. listed for copper cable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount safety switches in accordance with the N.E.C. Provide all mounting materials and mount safety switches vertically.
- B. In general, safety switches must be mounted on an independent and separate support system, not on the equipment being served. Where such an independent support would require penetrating or resting on a roof, it is preferable to mount on the equipment. In no case, however, may the switch interfere with access to or operation of the equipment, nor shall the switch be located within the significant impact zone of a flue or other high temperature component. Where screen walls are provided for outdoor units; the top of disconnect shall be below or equal to the top of screen wall.
- C. Coordinate final location of disconnect switches to provide a minimum of 36" clear in front of switch. Conduit may not be routed in access clear directly in front of disconnect switch.
- D. Install switches for all equipment that requires them. Mount so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.
- E. Disconnects mounted above ceiling must be mounted to be readily accessible near unit. Handle to be no more than 36" above ceiling grid.
- F. All exterior disconnects to be mounted below line of sight of a screen wall or if single disconnects, level with top of condenser. Verify location with Architect/Engineer prior to rough-in.

END OF SECTION

SECTION 26 28 16 - FUSES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide and install fuses as shown on the Drawings and as hereinafter specified.

1.02 STANDARDS

- A. Conform with the latest requirements of the National Electrical Code, NEMA and be UL listed.

1.03 ACCEPTABLE MANUFACTURERS

- A. Bussman
- B. Gould
- C. Little Fuse

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Time Delay/Dual Element (Class R) fuses 1/10 through 600 amps.
- B. Time Delay/Dual Element (Class RK5) fuses 1/10 through 200 amps for mechanical equipment and where noted.
- C. Time Delay (Class L) fuses 601 - 6000 amps.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Fuses shall not be installed until equipment is ready to be energized.
- B. Test and inspection shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening and review of all electrical connections and inspection of all grounding conductors.
- C. All fuses shall be furnished and installed by the Electrical Contractor.
- D. All fuses shall be of the same manufacturer.
- E. **Equipment Fuses: Verify final fuse size with actual equipment being installed. Do not exceed permitted fuse size and voltage of manufacturer ratings.**

RESTROOM BUILDING

3.02 INSTALLATION

A. Mains, Feeders and Branch Circuits:

1. Circuit 0 to 600 amperes shall be protected by current limiting dual-element, time delay fuses. All dual-element fuses shall have separate overload and short-circuit elements. The fuse must hold 500% of rated current for a minimum of ten (10) seconds, with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted). They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.
2. Circuits 601 to 6000 amperes shall be protected by current limiting time delay fuses. Fuse link shall be pure silver links (99.9% pure), to limit the short circuit current let through valves to low levels and comply with NEC Sections requiring component protection. Fuses shall be time-delay and must hold 500% of rated current for a minimum of four (4) seconds with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L. "CAUTION" labels to alert the end user of engineered level of protection of the electrical equipment, shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.
3. Motor Circuits - All individual motors rated for 200 horsepower or less shall be protected by time delay/dual-element fuses. The fuses for motors shall be installed in ratings approximately 125% of motor full load current, except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to a full speed quickly, such as large fans. Motors shall be protected by fuses of the rating shown on the Drawings. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted) Dual Element/Time Delay. "CAUTION" labels to alert the end user of the engineered level of protection of the electrical equipment shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

B. Spares:

1. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in cabinet as identified in Specification Section 26 05 00.

END OF SECTION

SECTION 26 28 25 - CONTACTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide lighting contactors as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

- A. Approved per UL 508 and designed in accordance with NFPA 1C52-211B.
- B. UL listed.
- C. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittals for contactors.
- B. Provide shop submittal which includes the following information:
 - 1. Voltage and ampere rating
 - 2. Wiring diagram
 - 3. Enclosure type
 - 4. Coil voltage

PART 2 - PRODUCTS

2.01 GENERAL

- A. Continuously current rated.
- B. Capable of making and breaking all cases of loads without the aid of auxiliary arcing contacts. Auxiliary arcing contacts are not acceptable.
- C. Industrial duty rated for applications to 600 volts maximum.

RESTROOM BUILDING

2.02 MATERIALS

- A. Totally closed, double break, silver to silver power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
- B. Provide terminals with straight through wiring and accept copper wire.
- C. Provide switches or provisions for switches as indicated on the drawings.
- D. Unless otherwise indicated, provide contactor in NEMA Type 1 enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount lighting contactor. Provide all mounting hardware.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown.

1.02 STANDARD

- A. Provide all materials and accessories, whether specifically described or not, of the best grade of the commercial manufacturer. Provide first class workmanship in every respect.
- B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures is not acceptable.
- C. Manufacture all lighting fixtures in accordance with the National Electrical Code.
- D. Ballasts:
 - 1. Provide ballasts for fluorescent lamps which meet U.L. specifications for Class P listing, applicable ANSI Standard Ballast Specifications, and certified by C.B.M.
Maximum - 2 lamps per ballast.
 - 2. Provide ballasts for HID lamps which comply with the UL Standard for High-Intensity Discharge Lamp Ballasts.
- E. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania. (3500K)

1.03 ACCEPTABLE LIGHTING PACKAGES:

- A. Lithonia
- B. Thomas Daybrite
- C. Hubbell
- D. Others Fixtures as Scheduled or Noted

1.04 SUBMITTALS

- A. Furnish Engineer shop drawings for each fixture.
- B. Provide shop drawing which includes the following information:
 - 1. Fixture type per the fixture schedule.
 - 2. Manufacturer of the fixture.
 - 3. Physical dimensions of the fixture.
 - 4. Manufacturer's standard finish.

RESTROOM BUILDING

5. Fixture output distribution curves with utilization parameters.
 6. Ballast temperature rating, voltage, wattage, and manufacturer.
 7. Material type and thickness of lens.
 8. Accessories for installation such as swivel hangers.
 9. Number and type of lamps.
- C. Submit point-by-point lighting calculations for areas as required by the specifications or noted on the drawings. The calculations shall include lamp lumen depreciation, luminaire dirt depreciation, ballast factor, lamp tilt factors, and initial lamp lumens. The calculations shall indicate maintained horizontal footcandle levels at a height of thirty inches above the floor. In interior spaces the maximum point spacing shall be five feet on center; for outdoor applications the maximum point spacing shall be 30 feet on center unless otherwise noted on the drawings.
- D. Lighting Control Submittal
- Shop Drawing Floorplan drawings at 1/8" scale showing
 - motion sensor layout as directed on plans
 - daylight sensor layout as directed on plans
 - identify enabled fixtures
 - identify power packs
 - identify power pack location for open ceiling areas (above panel in electrical room)
 - symbol legend identifying symbols
 - control sequences
 - riser diagrams showing low voltage cabling requirements
 - cutsheets all parts

1.05 PRODUCTS STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

1.06 COORDINATION

- A. Catalog numbers shown on the light fixture schedule may not include or adequately represent all the options and accessories required herein, this contractor shall conform to these specifications in there entirety.
- B. The various ceiling types are indicated on the architectural plans and in the room finish schedules. All lighting fixtures shall be coordinated with the architectural requirements to insure that the proper trim kit, and/or mounting accessory is provided with each fixture for the intended application. All trim kits and accessories shall be provided by Contractor whether or not they are specifically indicated by the manufacturer's catalog numbers on the lighting fixture schedule.
- C. The locations of all lighting fixtures are approximate. Locations are subject to modifications at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide all fixtures as called for in the schedules complete with lamps.
- B. Provide manufacturer's standard finish unless otherwise noted.
- C. Design all recessed or semi-recessed fixtures compatible with ceilings as installed. Provide frames where required for proper installation.
- D. Furnish complete, all fixtures requiring end caps, mounting spacers or other necessary items whether the catalog number shown includes such items or not.
- E. Conceal all fixture parts within the fixture construction.
- F. **Self locking lenses/latches are not acceptable.**
- G. Lighting fixture construction shall effectively eliminate light leaks between the frame, lens, housing and the interior finish surface. Furnish one lens hold-down clip at two foot centers.
- H. Linear fluorescent lampholders shall be turn type, medium base, bi-pin, 660 watt, 600 volt.
- I. Conceal all fixture parts, including emergency components, within the fixture construction.
- J. Fixture construction shall allow parts and lens to be replaced without special tooling.
- K. Fixture shall be provided with disconnecting means per NEC 2008.

2.02 FLUORESCENT LIGHTING FIXTURES

- A. Grid troffers (lay-ins) must conform to the following:
 - 1. Steel housing with T-bar clips.
 - 2. Flush steel door frame with metal rotary action latches. Door latches or hinges from either side.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern a with minimum thickness of 0.095 inches.
- B. Wet location troffers must conform to the following:
 - 1. Steel housing.
 - 2. Flush aluminum door frame with metal rotary action latches.
 - a. Door latches or hinges from either side.
 - b. Neoprene gasketing between the lens, doorframe, housing and mounting surface.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with internal prisms and a minimum thickness of 0.125 inches.

RESTROOM BUILDING

- C. Surface or stem mounted fixtures with a lens must conform to the following:
 - 1. Steel housing.
 - 2. Flush steel door frame with metal rotary action latches.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with a minimum thickness of 0.095 inches.
- D. Strip lights must conform to the following:
 - 1. Steel, heavy duty construction.
 - 2. 4 foot lamp lengths. Tandem, double length units are acceptable.
 - 3. Lampholder are secured by a screwed-on end plate.
 - 4. 4 foot wireguards. Tandem units require 2.

2.03 COMPACT FLUORESCENT LIGHTING FIXTURES

- A. Compact fluorescent downlights must conform to the following:
 - 1. Galvanized steel frame with adjustable hangers.
 - 2. Outdoor and wet area fixtures shall be lensed, gasketed and listed for wet locations. Only lenses which are flat shall be provided.
 - 3. Electronic ballast if available.

2.04 FLUORESCENT BALLAST

- A. Ballast which are located outdoors and in un-heated indoor areas shall be rated for reliable starting to 0 degree F.
- B. All fluorescent ballasts must conform to the following:
 - 1. Thermally protected Class P with auto restart circuitry.
 - 2. Class "A" sound rating.
 - 3. Power factor equal to or greater than 90.
 - 4. Contain no PCBs or asbestos.
 - 5. Certification Ballast Manufacturers (CBM) approved.
 - 6. Provide Quick Disconnect (QD) option for quick disconnecting of all ballasts.
- C. Linear fluorescent ballast must conform to the following:
 - 1. Fixtures with three or more lamps shall have two ballast to accommodate dual level switching. Provide 1 or 2 lamp ballasts. Do not use 3 and 4 lamp ballasts. All ballast are to be installed within the fixture of the lamps served.
 - 2. Electronic, instant-start and parallel-connected.

RESTROOM BUILDING

3. Enclosed in a metal enclosure.
4. Provided with integral, color coded leads.
5. Operate at a frequency of 20kHz or greater with less than 3 % visible lamp flicker.
6. Input current total harmonic distortion (THD) shall not exceed 10%.
7. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.
8. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts.
9. Provide transient immunity.
10. Allow remaining lamp(s) to maintain full light output if one or more lamps fail.
11. Tolerate sustained open circuit and short circuit output conditions without damage.
12. Tolerate operation of up to 65 deg. C. case temperature without damage.
13. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).

D. Compact fluorescent ballast must conform to the following:

1. Operate at a frequency of 20kHz or greater with less than 3 % visible lamp flicker.
2. Input current total harmonic distortion (THD) shall not exceed 20%.
3. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.
4. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts.
5. Provide transient immunity.
6. Tolerate sustained open circuit and short circuit output conditions without damage.
7. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).

2.05 FLUORESCENT POWER PACKS

- A. Where indicated, furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.
- B. Fluorescent power packs must conform to the following:
1. Suitable for use in both normal and emergency operational modes.
 2. Compatible with magnetic and electronic, instant start, 4 foot T8 lamps.

RESTROOM BUILDING

3. Produce 1000 to 1400 lumens initial emergency light output.
 4. Operate one lamp in each fixture for a minimum of 90 minutes.
 5. Steel housing, approx. 9 3/8" long, mounted concealed within the ballast channel.
 6. Test switch and pilot light mounted on the ballast channel cover.
- C. Label emergency lighting power packs, using a black marking pen, with the identity of the un-switched circuit.

2.06 EMERGENCY EXIT LIGHTS

- A. Exit lights must conform to the following:
1. Furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.
 2. Meet or exceed the current NFPA requirements.
 3. Light emitting diode (LED) type.
 4. Die-cast aluminum.
 5. Concealed and removable directional chevron knock-outs.
 6. Stencil face.
 7. Red letter color.
- B. Label power packs, using a black marking pen, with the identity of the un-switched circuit.

2.07 METAL HALIDE FIXTURES

- A. Metal halide downlights must conform to the following:
1. Galvanized steel frame with adjustable hangers.
 2. Outdoor and wet area fixtures shall have flat tempered glass lens with gaskets.
 3. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.
- B. High and low bay light fixtures must conform to the following:
1. Die-cast aluminum housing.
 2. Pendant splice box which allows the fixture housing to slide on.
 3. Enclosed glass reflector for high bay
 4. Enclosed acrylic reflector for low bay.
 5. Porcelain, mogul lamp socket of copper alloy with nickel plated screws, shell and center contact.

RESTROOM BUILDING

6. Full wire-guard, 2 piece, to protect the lens and the reflector.
 7. Safety chain.
 8. Outdoor and wet area fixtures shall have gaskets.
- C. Recessed squares (2 X 2, T-bar and non-T-bar mounted) must conform to the following:
1. Steel housing.
 2. Earthquake clips.
 3. Flush steel door frame with metal rotary action latches.
 4. Flat tempered prismatic glass lens.
 5. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.

2.08 HIGH INTENSITY DISCHARGE BALLAST

- A. All metal halide ballasts must conform to the following:
1. Field replaceable without the need of special tools.
 2. Core and coil, lag type, high reactance, autotransformer, high power factor ballasts for 50-150 watt ballast.
 3. Core and coil, constant wattage, autotransformer, high power factor ballasts for 175-1500 watt ballast.
 4. All ballast must conform with ' Energy Independence and Security Act 2007'.
- B. Library ballast shall achieve an "A" sound rating.

2.09 LAMPS

- A. Incandescent lamps shall be rated at 130 volt and have medium, screw, brass bases.
- B. Linear and compact fluorescent lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins.
- C. Mogul base HID lamps are preferred over medium bases.

2.09 LED LIGHT FIXTURE

- A. Power supplies must use Constant Current Reduction (CCR) for dimming.
- B. LED lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins for interior fixtures and 4100 Kelvins for exterior fixtures or as specified on drawings.
- C. Lamp life of minimum of 60,000 hours or as specified.
- D. Fixtures must be supplied with multiple power supplies for multi-level switching when specified.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set luminaries true, free of light leaks, warps, dents or other irregularities. Provide the length of stems as required to hang all luminaries level and in the same plane. **VERIFY THE TYPE OF ALL CEILINGS BEFORE ORDERING FIXTURES, AND PROVIDE FIXTURES AND MOUNTINGS TO SUIT.** Mount all fixtures at a position and height to clear equipment, ductwork, piping, etc., in mechanical rooms, storage rooms, etc. Provide appurtenances for all light fixtures, which include stud supports, stems, mounting brackets, frames and plaster rings.
- B. Support luminaries only from structural elements which are capable of carrying the total weight. Mount all lighting fixtures rigid with no rocking action. Provide 13/16" channels as needed.
- C. The locations of all lighting fixtures as shown are approximate. It is understood that they are subject to such modifications as may be found necessary or desirable at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.
- D. Install ballasts and fixtures in accordance with the NEC and ANSI Standards.
- E. Adjust all floodlights and spotlights to the satisfaction of the Engineer.
- F. Connect all exit lighting fixtures to the nearest unswitched circuit or the nearest emergency circuit. Connect all emergency lighting fixtures to same circuit as normal area lighting in same area per NEC Article 700
- G. Provide and install necessary hardware and accessories to maintain 1.5 inches clearance from combustible material on all light fixtures with ballast.
- H. Provide all exit signs with required directional arrows, to indicate direction of egress travel.
- I. **Fixtures shall NOT be daisy chained together.**
- J. Troffer (lay-in) lighting fixtures shall be supported from the building structure by a minimum 12 gage galvanized carbon steel soft temper hanger wires. Install two hangers at diagonally opposite corners of each lay-in light fixture 2'x4' or smaller and one hanger at each corner of each lay-in light fixture larger than 2'x4'. Supporting of light fixtures from ceiling system is not acceptable.
- K. Each recessed lighting fixture shall be separately connected to a junction box with a flexible wiring method (i.e. daisy chaining from fixture to fixture is not allowed). The flexible conduit from the junction box to the fixture shall not lay on the ceiling as finally installed and shall not exceed 6 feet in length.
- L. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.
- M. Pendant mounted light fixtures shall be provided with 3/4", threaded, rigid metal conduit, painted to match the fixture color.

RESTROOM BUILDING

- N. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface, provide gaskets as needed.
- O. Install high or low bay light fixtures between the joist with the bottom of the reflector flush with the bottom cord of the joist. Engineer will direct if obstructions such as ducts, beams, etc. are permanently installed below the joist.
- P. Locate mechanical, electrical, equipment, etc. room light fixtures to provide the best coverage and clear all obstructions such as ducts, piping, bracing and supports.
- Q. Fluorescent High Bay are to be rigidly mounted with all thread, $\frac{3}{4}$ " threaded rigid metal conduit and unistrut as required.

3.02 CLEAN UP

- A. Leave all fixtures in clean condition, free of dirt and defects.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all exterior lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown. Exterior lights shall be circuited through lighting contactor for time clock/photocell control.

1.02 STANDARDS

- A. Provide all materials and accessories, whether specifically described or not, of the best grade of commercial manufacturer. Provide first class workmanship in every respect.
- B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures will not be acceptable.
- C. Manufacture lighting fixtures in accordance with the National Electrical Code.
- D. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania.

1.03 ACCEPTABLE LIGHTING PACKAGES:

- A. Lithonia
- B. Thomas Daybrite
- C. Hubbell
- D. Others as scheduled or noted

1.04 SUBMITTALS

- A. Furnish Engineer shop drawings for each fixture.
- B. Provide shop drawing which includes the following information:
 - 1. Fixture type per the fixture schedule
 - 2. Manufacturer of the fixture
 - 3. Physical dimensions of the fixture
 - 4. Manufacturer's standard finish
 - 5. Lamp type recommended by the manufacturer
 - 6. Fixture output distribution curves and photometrics
 - 7. Ballast temperature rating, voltage, wattage, and manufacturer
 - 8. Material type of lens

RESTROOM BUILDING

- C. Furnish structural engineer with approved shop drawings on pole, post and Bollard light fixtures for purpose of designing fixture base.

1.05 PRODUCT STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide luminaire complete with the fixture housing, refractor, lamp, and ballast.
- B. Provide type, wattage, and voltage lamp designated on Drawings.
- C. Where indicated on Drawings, provide parking lot poles and floodlight poles.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Orient lighting fixtures as shown on Drawings.
- B. Adjust all floodlights and spotlights to the satisfaction of the Engineer.
- C. Coordinate exact location of lighting fixtures with Architect prior to rough-in.

3.02 CLEAN UP

- A. Leave all fixtures and poles in clean condition, free of dirt and defects.

END OF SECTION

SECTION 000107 - SEALS PAGE

PART 1 - Seals Page

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Ryan Hansanuwat.
2. 22732.
3. Responsible for Divisions 01-12 Sections except where indicated as prepared by other design professionals of record.

END OF SECTION 000107



SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type and color of the following:
 - 1. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

- A. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches** down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F** and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 3. Size (Width): Manufactured to the following dimensions:
 - a. 100 mm nominal; 92 mm actual.
 - b. 150 mm nominal; 143 mm actual.
 - c. 200 mm nominal; 194 mm actual.
 - d. 250 mm nominal; 244 mm actual.
 - e. 300 mm nominal; 295 mm actual.
 - f. 400 mm nominal; 396 mm actual.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than **1/4 inch** thick, use aggregate graded with 100 percent passing the **No. 16** sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, **Grade 60**.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: **0.148-inch** diameter.
 - 4. Wire Size for Cross Rods: **0.148-inch** diameter.
 - 5. Wire Size for Veneer Ties: **0.148-inch** diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than **16 inches** o.c.
 - 7. Provide in lengths of not less than **10 feet**, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.

2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, **G60** zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 666, Type 304.
 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 8. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.
- B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from **0.105-inch**-thick, steel sheet, galvanized after fabrication.
 - a. **0.064-inch**- thick, galvanized sheet may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch** of masonry face, made from **0.187-inch**- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 3. Corrugated Metal Ties: Metal strips not less than **7/8 inch** wide with corrugations having a wavelength of **0.3 to 0.5 inch** and an amplitude of **0.06 to 0.10 inch** made from **0.060-inch**-thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within **1 inch** of masonry face.
 - a. **0.064-inch**- thick, galvanized sheet may be used at interior walls unless otherwise indicated.
- C. Rigid Anchors: Fabricate from steel bars bent to configuration indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- 2.7 MISCELLANEOUS ANCHORS
- A. Anchor Bolts: Headed steel bolts complying with **ASTM A 307, Grade A** ; with **ASTM A 563** hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- 2.8 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi .
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus **1/2 inch** or minus **1/4 inch**.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus **1/2 inch**.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus **1/4 inch** in a story height or **1/2 inch** total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than **1/4 inch in 10 feet**, or **1/2 inch** maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet**, **1/4 inch in 20 feet**, or **1/2 inch** maximum.

3. For vertical lines and surfaces do not vary from plumb by more than $1/4$ inch in 10 feet , $3/8$ inch in 20 feet , or $1/2$ inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than $1/8$ inch in 10 feet , $1/4$ inch in 20 feet , or $1/2$ inch maximum.
5. For lines and surfaces do not vary from straight by more than $1/4$ inch in 10 feet , $3/8$ inch in 20 feet , or $1/2$ inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than $1/4$ inch in 10 feet , or $1/2$ inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus $1/8$ inch , with a maximum thickness limited to $1/2$ inch .
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than $1/8$ inch .
3. For head and collar joints, do not vary from thickness indicated by more than plus $3/8$ inch or minus $1/4$ inch .
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus $1/8$ inch .

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4 -inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 -inches . Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 -inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

- H. Fill cores in hollow CMUs with grout **24 inches** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide **1/2-inch** clearance between end of anchor rod and end of tube. Space anchors **48 inches** o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch** on exterior side of walls, **1/2 inch** elsewhere. Lap reinforcement a minimum of **6 inches**.
 - 1. Space reinforcement not more than **16 inches** o.c.
 - 2. Space reinforcement not more than **8 inches** o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than **8 inches** above and below wall openings and extending **12 inches** beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches .

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.

- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft.** of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of **3/4 inch**. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per foot**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 042300 - GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass block set in mortar.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: Glass-block units and joint materials involving color selection.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical exterior and interior panel, 48 by 48 inches in size.
 - 2. Build mockup of typical exterior wall area containing glass unit masonry assembly as shown on Drawings.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 40 deg F or higher.
 - 1. Maintain temperature in installation areas at 40 deg F or above for 48 hours after installing.
 - 2. Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or when joint substrates are wet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass Block: Obtain each type and pattern of glass block from single source from single manufacturer.
- B. Source Limitations for Accessory Materials: Obtain each cementitious material and accessory component through single source from single manufacturer and each aggregate from single source or producer.

2.2 GLASS BLOCK

- A. Hollow Glass Block: Hollow units made from transparent glass, with manufacturer's standard edge coating.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Seves Manufacturing
 - 3. Glass Color: Colorless.
 - 4. Pattern: Wavy, light-diffusive design on inner faces, and smooth outer faces.
 - 5. Edge-Coating Color: As indicated by manufacturer's designations.
 - a. Provide one color throughout for each pattern indicated.
 - b. Provide multiple colors as indicated for each size and pattern.
 - 6. Sizes: Manufacturer's standard sizes corresponding to nominal sizes indicated on Drawings.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
- E. Aggregate: ASTM C 144, with 100 percent passing No. 8 sieve.
- F. Water: Potable.

2.4 GLASS UNIT MASONRY ACCESSORIES

- A. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless-steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.
- B. Sealants: Manufacturer's standard elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants."
- C. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Section 079200 "Joint Sealants."

2.5 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
- B. Mortar for Glass Unit Masonry Assemblies: Provide mortar, mixed according to glass-block manufacturer's listing with testing and inspecting agency, for fire-resistance rating indicated.
- C. Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C 270, Proportion Specification for Type S mortar.
 - 1. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard mortar when it has reached initial set.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING GLASS BLOCK WITH MORTAR

- A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.
- B. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain **3/8-inch** exposed joint widths unless otherwise indicated.
- C. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.
- D. Use plastic spacers or temporary wedges in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.
 - 1. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.
- E. Keep expansion joints free of mortar.
- F. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
 - 1. If temporary wedges are used, remove them before raking out and pointing joints.
- G. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.
- H. Install sealant at jambs, heads, mullions, and other locations indicated. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Section 079200 "Joint Sealants."
- I. Construction Tolerances: Set glass block to comply with the following tolerances:
 - 1. Variation from Plumb: For vertical lines and surfaces, do not exceed **1/4 inch in 10 feet** , **3/8 inch in 20 feet** , or **1/2 inch in 40 feet** or more.

2. Variation from Level: For bed joints and other conspicuous lines, do not exceed $\frac{1}{8}$ inch in 10 feet , $\frac{1}{4}$ inch in 20 feet or $\frac{1}{2}$ inch in 40 feet or more.
3. Variation of Location in Plan: For location of elements in plan, do not vary from that indicated by more than plus or minus $\frac{1}{4}$ inch .
4. For faces of adjacent exposed units, do not vary from flush alignment by more than $\frac{1}{16}$ inch .

3.3 CLEANING

- A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.
- B. Remove excess sealants with commercial solvents according to sealant manufacturer's written instructions. Exercise care not to damage sealant in joints.
- C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 042300

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking[, cants,] and nailers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
 - 2. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
 - 3. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, [mark grade stamp on end or back of each piece] [or] [omit grade stamp and provide certificates of grade compliance issued by grading agency].
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: [15 percent][19 percent][15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness][15 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness][19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness] unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 [for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. [Do not use inorganic boron (SBX) for sill plates.]
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, [mark end or back of each piece] [or] [omit marking and provide certificates of treatment compliance issued by inspection agency].

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.

B. Concealed Boards: [15][19] percent maximum moisture content of [any of the following][the following] species and grades:

1. Mixed southern pine or southern pine, [No. 2][No. 3] grade; SPIB.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners [with hot-dip zinc coating complying with ASTM A 153/A 153M][of Type 304 stainless steel].

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches** o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal** thickness.
 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft.** and to solidly fill space below partitions.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet** o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish

materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for [screeding or] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof sheathing.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 ROOF SHEATHING

- A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exterior sheathing.
 - 1. Nominal Thickness: Not less than 15/32 inch .

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
1. Wall and Roof Sheathing:
 - a. Nail to wood framing.
 - b. Space panels **1/8 inch** apart at edges and ends.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood roof trusses.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for roof sheathing and subflooring.
- C. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.

- B. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S.
 - 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061053 "Miscellaneous Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Source Limitations: Obtain metal connector plates from single manufacturer.
- B. General: Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
 - 1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.6 FABRICATION

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

2.7 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061053 "Miscellaneous Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- K. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

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- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 061753

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes standing-seam metal roof panels.
- B. Related Sections:
 - 1. Section 074213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.
 - 2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
- b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. .
- B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels:- Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 - 1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch .
 - b. Exterior Finish: Two-coat fluoropolymer.

- c. Color: As selected by Architect from manufacturer's full range.
- 2. Clips: One-piece fixed to accommodate thermal movement.
 - a. Material: **0.028-inch**- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
- 3. Joint Type: As standard with manufacturer.
- 4. Panel Coverage: **24 inches** .
- 5. Panel Height: **2.0 inches** .

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils** thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at **240 deg F** ; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus **20 deg F** ; ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch**-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable

variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations

indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches** . Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.
 2. Apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of **24 inches** beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of **18 inches** . Overlap ends of sheets not less than **6 inches** .
 - c. Rake edges for a distance of **18 inches** .
 - d. Hips and ridges for a distance on each side of **12 inches** .
 - e. Roof-to-wall intersections for a distance from wall of **18 inches** .
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **18 inches** .
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet** with no joints allowed within **24 inches** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of

intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof-edge specialties.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 074113.16 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces.

2.2 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - 1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal thickness as required to meet performance requirements.
 - a. Surface: Embossed finish.
 - b. Finish: Insert finish.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and continuously welded.
 - 3. Splice Plates: Exposed, of same material, finish, and shape as fascia cover.
 - 4. Receiver: Manufacturer's standard material and thickness.
 - 5. Special Fabrications: Radiussed sections.
 - 6. Fascia Accessories: Fascia extenders with continuous hold-down cleats.

2.3 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F .
 - 2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F .

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches**. Roll laps with roller. Cover underlayment within 14 days.
1. Apply continuously under roof-edge specialties.
 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of **12 feet** with no joints within **18 inches** of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between **40 and 70 deg F**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F**.

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches ; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ceco Door
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. All Doors.
 1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch , with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Core: Vertical steel stiffener.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch , with minimum A40 coating.
 - b. Construction: Full profile welded.
 4. Exposed Finish: Prime.

2.4 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.5 FRAME ANCHORS

- A. Jamb Anchors:

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

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches , as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 2. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

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- b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
6. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
- 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
- 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

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AND FRAMES

- b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - d. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus $1/16$ inch , measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus $1/16$ inch , measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus $1/16$ inch , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus $1/16$ inch , measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: $1/8$ inch plus or minus $1/32$ inch .
 - b. Between Edges of Pairs of Doors: $1/8$ inch to $1/4$ inch plus or minus $1/32$ inch .
 - c. At Bottom of Door: $3/4$ inch plus or minus $1/32$ inch .
 - d. Between Door Face and Stop: $1/16$ inch to $1/8$ inch plus or minus $1/32$ inch .

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Counter doors.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for finish painting of factory-primed doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
 - 1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY-

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.
- C. Door Curtain Material: Aluminum.
- D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.
 - 1. Insulated-Slat Interior Facing: Metal.
 - 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated hot-dip galvanized steel and finished to match door.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Integral Frame, Hood, and Fascia: Galvanized steel.
 - 1. Mounting: Face of wall.
- H. Sill Configuration: No sill.
- I. Locking Devices: Equip door with slide bolt for padlock.
- J. Manual Door Operator: Chain-hoist operator.
 - 1. Provide operator with through-wall shaft operation.
- K. Curtain Accessories: Equip door with weatherseals and push/pull handles.
- L. Door Finish:

1. Aluminum Finish: Clear anodized.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 1. Aluminum Door Curtain Slats: **ASTM B 209** sheet or **ASTM B 221** extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of **0.050 inch** ; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
 1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.5 HOODS

- A. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
 1. Galvanized Steel: Hot-dip galvanized steel sheet with **G90** zinc coating, complying with ASTM A 653/A 653M.

2.6 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 CURTAIN ACCESSORIES

- A. Weatherseals: Equip door with weather-stripping gaskets fitted to entire perimeter of door for air-resistant installation unless otherwise indicated.
 - 1. At door head, use **1/8-inch**-thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, **1/8-inch**-thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft.** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **25-lbf** force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include three months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components,

lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

END OF SECTION 083313

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
- B. Related Sections:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
 - 2. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
- C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
 - 1. Permanent lock cores to be installed by Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- a. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
- b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
- c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
- d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Fastenings and other pertinent information.
 - 5) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6) Mounting locations for door hardware.
 - 7) List of related door devices specified in other Sections for each door and frame.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- F. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant [and Owner's security consultant]. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.
 - 4. Requirements for access control.
 - 5. Address for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum

requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches ; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

- B. Pin-and-Barrel-Type Hinges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Deadbolts: Minimum 1.25-inch bolt throw.

- C. Lock Backset: 2-3/4 inches , unless otherwise indicated.

- D. Lock Trim:

1. Levers: Cast.
2. Knobs: Wrought.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.5 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturer: Same manufacturer as for locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
 - 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: Information to be furnished by Owner.

2.7 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.8 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.9 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed **0.50 cfm per foot** of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.10 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.11 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and

hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 - 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.12 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches .
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

END OF SECTION 087100

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. .
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

- C. Colors: As selected by Architect from manufacturer's full range.

2.2 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Portland Cement Plaster: 12 percent.
 - 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No. 4.
 - 4. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. High-Build Latex System: Dry film thickness of not less than **10 mils**.
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. .
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Room-identification signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for signs.

2.2 SIGNS

- A. Room-Identification Sign-: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Beveled.
 - b. Corner Condition in Elevation: Square.
 - 2. Mounting: Manufacturer's standard method for substrates indicated with
 - 3. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-plastic toilet compartments configured as urinal screens.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS-

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley or comparable product by one of the following:
 - 1. Bobrick
- C. Urinal-Screen Style: Wall hung.
- D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer.
 - 1. Polymer Color and Pattern: Matching pilaster.
- E. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.

- B. Aluminum Extrusions: **ASTM B 221** .
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: **1/2 inch** .
 - b. Panels and Walls: **1 inch** .
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open

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approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
- B. Related Sections:
 - 1. Section 088300 "Mirrors" for frameless mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Combination Toilet Tissue Dispenser:-
 - 1. Basis-of-Design Product: Bobrick B-3888.
 - 2. Mounting: Partition mounted, dual access with two tissue rolls per compartment.
 - 3. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch-diameter tissue rolls.
 - 4. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 6. Lockset: Tumbler type.

B. Liquid-Soap Dispenser-:

1. Basis-of-Design Product: Bobrick B-2112.
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Horizontally oriented, surface mounted.
4. Capacity: 40 oz.
5. Materials: Stainless Steel.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

C. Grab Bar <Insert drawing designation>:

1. Basis-of-Design Product: Bobrick.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches .
5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit-:

1. Basis-of-Design Product: Bobrick B-165 2436.
2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lbf**, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."
 - 2. Section 233813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.3 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
- B. Regular Dry-Chemical Type-: UL-rated- nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS-

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: **54 inches** above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

RESTROOM BUILDING FOR CITY OF DEER PARK SOCCER COMPLEX

Mechanical/Electrical Specifications



B.J. Hendrix

03/08/2017

F-4095

MEP/ENERGY CONSULTANTS



COMMISSIONING • FIELD INVESTIGATIONS

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ROUND ROCK, TX 78664
F-4095

DIVISION 20, 22 & 23

RESTROOM BUILDING FOR

CITY OF DEER PARK SOCCER COMPLEX

MECHANICAL SPECIFICATIONS

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B.J. Hendrix

03/08/2017

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SECTION 20 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work of Division 20-24 consists of providing labor, materials, products, and all operations required for the complete operating installation of all mechanical systems as shown and specified, in strict compliance with applicable drawings, specification, terms and conditions of the contract and all applicable codes and ordinances governing the installation of the various mechanical systems. Contractor shall provide all equipment and materials necessary and usually furnished in connection with such work and systems whether or not specifically mentioned in the specifications or on the drawings. All work shall be fully correlated with the work of other crafts. This section of Division 20-24 is a part of all other sections of Division 20-24.
- B. Each Contractor shall study the Contract Documents included under this contract to determine exactly the extent of work provided under this contract, as well as to ascertain the difficulty to be encountered in performing the work on the drawings and outline hereinafter and in making new connections to existing utilities, installing new equipment and systems and coordinating the work with the other Trades.
- C. Notwithstanding any approvals or instructions which must be obtained by the Contractor from the Architect in connection with use of premises, the responsibility for the safe working conditions at the site shall remain that of the Contractor's, and the Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.
- D. The Agreement Forms, Uniform General Conditions, Supplementary Conditions, Division 00 and Division 01 of the specifications shall apply to the work specified in Division 20-24.
- E. Additional Site Visit Costs: Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.
- F. The Contractor shall obtain and pay for all permits and fees associated with his work.
- G. REMODEL WORK: COORDINATE ALL CONNECTIONS OF NEW EQUIPMENT WITH EXISTING SERVICE. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT, MATERIALS, AND INCIDENTAL ITEMS REQUIRED TO MAKE SYSTEM COMPLETE AND OPERABLE.
- H. **NO TOXIC OR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED. ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
- I. **An extra copy of all Field Reports shall be kept in a separate notebook set up in the Construction Manager's Trailer. Contractors shall use these reports to check off that each individual item noted has been completed. Each item shall be initialed and noted when completed. Use this notebook to keep record of all test and results (i.e. wastewater test, water line tests, etc.**

J. **Drawings:**

Architectural Background Files – Architectural Revit Models and CAD files to be used for background files, MEP drawings are not background files. Architectural Revit Models and CAD files are used for shop drawings backgrounds. They must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of \$500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

MEP CAD Files that will be released.

- If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- Fire Alarm/Fire Sprinkler/Intercom etc... Contractors must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read.

1.02 PRE CONSTRUCTION MEETING

- A. DDC Contractor, Mechanical Contractor, Test and Balance Representative and representatives for each type of HVAC gear that requires interface beyond 'on/off' control will meet in the office of HCE prior to initial control submittal.
- B. The purpose of this meeting is to introduce all representatives who will need to coordinate with each other to insure a working project.
- C. Each representative is to come prepared with sequences of operation, schematics and written instructions as to which points require what type of signal for each function and how tie-ins and integrations are to occur. If pulsed signals are required to keep a device on, bring it to the attention of the team and provide specific information. Do not assume others understand the inner workings of your gear or controls. Discuss exactly what type signals are acceptable to gear and how to set it up to receive and act on that signal.
- D. Newer multistage air volume split systems, RTU's, etc. have different sequences and control tie-ins than older conventional units. Exact requirements for a given type and brand of equipment must be coordinated by the equipment supplier with the Controls Contractor and with the Test and Balance Contractor.
- E. Test and Balance Contractor must verify air flow and delta T's at every stage of unit capacity to insure that unit is providing the correct CFM based on the capacity stage it is on so that the unit does not end up with low stage cooling and high stage blower which will not dehumidify. Equipment supplier is to provide Test and Balance Contractor with a quick start up guide to show where and how to set up fan speed selections and outside air dampers so that only minor balancing occurs at dampers serving grilles.

RESTROOM BUILDING

1.03 SITE INSPECTION

- A. Prior to bidding the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.
- B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.04 RELATED WORK SPECIFIED ELSEWHERE

- A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.
 - 1. Electrical Specifications: Division 26-28.
 - 2. Mechanical, Electrical, Plumbing Drawings
- B. Unless otherwise indicated on the Electrical Drawings or in Mechanical Specifications, provide all mechanical equipment motors, motor starters, disconnect switches, thermal overload switches, control relays, time clocks, thermostats, motor valves, damper motors, electric switches, electric components, wiring, and any other miscellaneous Division 20-24 controls.
- C. Carefully coordinate all work with the electrical work shown and specified elsewhere in these documents.
- D. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than plus or minus 10 percent of rated voltage.
- E. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- F. Size motors for 1.15 service factor, not to exceed 40 degrees temp. Rise above ambient.
- G. Provide self-resetting thermal overload switch for fractional horsepower motors.
- H. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.
- I. **The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings and any change in equipment and/or motor size or type brought on directly or indirectly by a substitution of mechanical equipment having**

characteristics requiring a change, shall be the responsibility of the Mechanical Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show any deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

- J. Mechanical contractor assumes requirements of Controls Contractor when there is no separate Controls Sub-Contractor.**

1.05 WORK NOT INCLUDED

- A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

1.06 SPECIFICATION TERMINOLOGY (Definitions)

- A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.
- B. "Furnish" means to purchase and deliver material as shown and specified, including mark-ups, and cart the material to an approved location at the site or elsewhere, as noted or agreed.
- C. "Provide/Install", as used in these specifications, means furnish all material, labor, sub-contracts, and appurtenances, including mark-up required for a complete, operating, finished system.
- D. "Rough-in and Connect Only" means provide an appropriate system connection, such as supplies with stops, continuous wastes with traps, shut-off valves required, and all piping connections, testing, etc., for proper operation, and to install equipment furnished. Equipment furnished is received, uncrated, assembled and set in place by supporting crafts unless they make prior arrangements to hire the mechanical installer for this work.
- E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. It shall also be no more than four feet (4') above a ceiling.
- F. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction, or damage to the surrounding installation.
- G. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.
- H. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

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- I. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit. "Piping" includes, in addition to piping, all fittings, valves, hangers and other accessories relative to such piping.
- J. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, crawl spaces, etc.

1.07 DIAGRAMMATIC DRAWINGS

- A. Drawings and specifications encompass a system that will integrate with the structural, electrical, and Architectural design of the building.
 - 1. Drawings and specifications are complementary, each to the other; what is shown on one is as binding as if called for in both.
 - 2. Where drawing details, plans, and/or specification requirements are in conflict, and where conduit, duct and piping sizes of the same run are shown to be different between plans and specifications or details, the most stringent requirement will be included in the Contract. Systems and equipment called for in the specification and/or shown on the drawings shall be provided under the contract of each Trade as if it were required by both the drawings and the specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to the Architect's attention for direction as to what is to be provided.
- B. The drawings are partly diagrammatic in character and do not show exact locations, all offsets or give exact elevation in piping, fittings, duct, conduits, etc. Also, the drawings do not necessarily show in minute detail all features of the installation. Contractor shall physically arrange the systems to fit in the space available and shall carefully investigate structural and finish conditions, arrange work accordingly and provide a complete and satisfactorily working installation. Provide all work shown on the drawings and specified, unless otherwise stated. No subsequent allowance will be made due to failure to coordinate work prior to installation.
- C. The Architectural, Structural, Civil and Electrical plans and Specifications and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Mechanical Drawings and shall be complied and coordinated with in every respect. All drawings and specifications mentioned above shall be examined by all bidders. Failure to examine all drawings for coordination and quantities shall not relieve the Contractor of responsibility and no subsequent allowance for time or money will be allowed.

1.08 MATERIAL AND EQUIPMENT SUBMITTALS

- A. Submittals: Provide submittals for all products and systems described in Division 20-24 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.
- B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) cover will be returned and required to be broken into separate submittals.** The Engineer's check will be general and

does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

- C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**
- D. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**
- E. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section. Separate PDFs for each Submittal number.**
- F. **HARDCOPY SUBMITTAL REQUIREMENT: Hardcopy submittals will not be required by Engineer.**
- G. **PDF SUBMITTAL REQUIREMENT:**
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected.**

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays cause by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

- H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc. will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**
- I. **SUBMITTALS WILL BE RETURNED IN ORDER OF CONSTRUCTION OF THE PROJECT, NOT NECESSARILY IN ORDER SUBMITTED.** If all sections are submitted under one binder and transmittal, each section will be returned at the appropriate time for construction phasing. Mechanical Equipment will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Mechanical Equipment, Mechanical Controls and Plumbing Fixtures may require extended review time. **IF SUBMITTALS ARE SUBMITTED EARLY RELATIVE TO CONSTRUCTION PHASING, SUBMITTALS MAY BE HELD, REVIEWED AND RETURNED AT THE APPROPRIATE TIME FOR CONSTRUCTION PHASING, NOT NECESSARILY 2 WEEKS.**

- J. **DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications submittal will be required. (Write summary sheet of deviations and highlight items that are different to allow for proper review.):**

Isolators	Fire Smoke Dampers / Details
Relief Valves	Valves
Insulation	Gauges
Spin-in Fittings	Flexible Duct
Fire Dampers Installation Detail	Volume Damper
Fire Damper	Air Extractors
Valve Tag / Markers	Access Panels
Flexible Connector	Pipe Identification / Labels
Grease Traps	Duct Tape

- K. **PDF Submittals Allowed for Product Cut-Sheets for are limited to the following items: Separate PDF for each Submittal number is required.**

Mechanical/Electrical Coordination Sheet	
Fire Sprinkler Product Data	Condensers
Internal Lining	Metal Jacket & Fittings
Exhaust Fans	Exhaust/Relief Caps
Supply Fans	Grilles/Registers/Diffusers
Unit Heaters	Pumps
Water Heaters	Plumbing Fixtures and Trim
Cleanouts	Floor Drains
Condensing Units/Heat Pumps	Piping

- L. **Data Required for Review: Mark submittal literature and shop drawings clearly by individual sections, and include all equipment and material shown on drawings and specified. ANY DATA NOT CLEARLY MARKED OR NOT APPROPRIATELY SUBMITTED WILL BE RETURNED WITHOUT CHECKING. Indicate the following:**

1. Specification reference and/or drawing reference for which literature is submitted for review with an index, following specification format, and item by item identification.
2. Manufacturer's name and address, and supplier's name, address, and phone number.
3. Catalog designation or model number.
4. Rough-in data and dimensions.
5. Performance curves and rated capacities with performance data marked.
6. Motor characteristics and wiring diagrams.
7. Operation characteristics.
8. Complete customized listing of equipment, characteristics, accessories, etc., specified. Indicate whether item is "As specified." Mark out all non-applicable items. The terminology "As specified" used without this customized listing is not acceptable.

9. Wiring diagrams for the specific system operation. Complete wiring with diagrams showing all connections to each type of actual equipment being installed on project, complete with part numbers of controls for each type of equipment.
 10. **Submit written sequence of operation for all modes of operation for each piece of mechanical equipment. Give narrative explaining exactly what control signals are required to activate each mode of a particular unit's operation. Include information about which signals override others internally (when applicable). Submit this information with equipment submittal and provide a copy to the Controls Contractor so it can be integrated into the control scheme and control submittals. Indicate whether 24 VAC, 4-20 MA, 0-10VDC or line voltage is required for controls.**
 11. **Provide HVAC equipment with a controls interface that is suitable for connection to a standard conventional thermostat and/or non-proprietary DDC control systems.**
 12. **Ductwork Shop Drawings: Engineer requires 1 (one) HARDCOPY, full-size at 1/8" scale, sheets size to match project for engineer review and engineer records. Additional copies per Architect and Owner requirements. PDF's will be required for owner and architect records.**
 13. **BREAKOUT SUBMITTALS INTO PRIORITY ITEMS.**
- M. **Contractor to submit "Mechanical/Electrical Equipment Coordination Sheet" with equipment submittal for all HETD's, RTU's, GU's, AHU's, CU's, HP's and MAU's. Reference chart at end of section.**
- N. When requested, present samples of all materials proposed for use to the Engineer for his approval.
- O. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.
- P. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.
- Q. **Substitutions:** ("Substitution Request" form must be submitted)
1. Equipment listed as equal is indicated to be equal in quality to equipment designed around. It does not mean equal in dimension or fit. It is the Contractor's responsibility to confirm dimensional differences and space requirements.
 2. Request for proposed substitution of materials, methods, or processes shall be made to the Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.
 3. **Equal Materials:** It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity, and other characteristics.

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4. Acceptance of substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and of work on schedule.
5. Where equipment of the acceptable manufacturers requires different arrangement or connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor proposing substitutions shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under other Sections, including location of rough-in connections by other Trades, conduit supports, insulation, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.
6. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**
8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**
 - a. Mechanical Equipment
 - b. Contractor Cost Savings Packages Requiring Substantial Review Time

1.09 SHOP DRAWINGS REQUIRED

- A. **Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination. Provide shop drawings for all products, ductwork, systems, system components and special supports which are not standard catalog products and which may be fabricated for the Contractor or by the Contractor. Show top and bottom elevation of ductwork and equipment as it will be installed. Show offsets required to miss structural and other items of interference. Identify all shop drawings as to which section and paragraph of the specifications and/or drawing number the item is covered under. Ductwork layout/shop drawings to be done at a minimum 1/8" = 1'-0" scale. AHU's, CU's, HP's, RTU's, etc. are to be shown actual scaled size and configuration of the actual equipment being used.**
- B. Architectural Revit Models and CAD files to be used for backgrounds in preparation of ductwork and sprinkler shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

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- C. ALL SHOP DRAWINGS OF MECHANICAL ROOMS/MEZZANINES SHALL SHOW ALL FLOOR DRAINS, HVAC, PLUMBING, AND ELECTRICAL EQUIPMENT, INCLUDING ELECTRIC PANELS, TRANSFORMERS AND DISCONNECT SWITCH LOCATIONS. COORDINATE WITH ELECTRICAL AND PLUMBING CONTRACTOR.
- D. Provide roof shop drawing indicating dimensioned locations and sizes for all roof mounted equipment, supports, openings and plumbing vents in ample time for proper coordination of all trades.
- E. Submission of copies of the Engineer's drawings does not constitute shop drawings and is not acceptable.
- F. Submittal of complete engineering submittal data for products and equipment shall be made in sufficient copies to provide one (1) hardcopy of all data to be retained by the Engineer, additional copies as required by the Contractor, Architect and Owner. Provide an electronic copy in PDF format and CAD if available for record keeping purposes for Engineer, Architect, and Owner with close out documents described elsewhere in specifications.
- G. **General Contractor shall transmit a CAD copy of ductwork shop drawings to sprinkler contractor prior to submission of sprinkler shop drawings.**
- H. Ductwork shop drawings shall be submitted and reviewed prior to any ductwork being installed.
- I. **MECHANICAL CONTRACTOR MUST SUBMIT "MECHANICAL/ELECTRICAL COORDINATION SHEET" WITH MECHANICAL EQUIPMENT SUBMITTAL FOR PROPER COORDINATION PURPOSES WITH ELECTRICAL CONTRACTOR FOR ACTUAL EQUIPMENT BEING INSTALLED OR SUBMITTAL WILL BE REJECTED.**

1.10 RECORD DRAWINGS

- A. Reference requirements stated elsewhere in the Specifications.
- B. THE CONTRACTOR SHALL TAPE ALL ADDENDA'S ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THE CONTRACTOR HAS COMPLIED WITH THIS REQUIREMENT.
- C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the General's site trailer and marked up weekly as the work progresses, to show exact dimensioned location and routing of all mechanical work which will be permanently concealed. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Show the location of all valves and their appropriate tag identification. Indicate locations of all existing active and inactive piping uncovered during construction. **Keep marked up set at site for review at site meetings.**
- D. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed for draw requests. They shall be inspected periodically by the Architect and Owner's Representatives, and they shall be corrected immediately if found either inaccurate or incomplete. **This procedure is mandatory.**
- E. The Contractor shall be responsible for updating and/or marking all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job, marked up As-Built Drawings shall be

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submitted to the Architect for final review and comment. These corrected prints together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

- F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contractor shall provide pdf copies/scans for owner record purposes.
- G. The Contractor shall bear all the costs of producing the "Record Drawing Set".
- H. All equipments **model and serial numbers** must be included on start up forms turned in to the owner. For split systems, this includes all model and serial numbers for all indoor sections or components as well as outdoor units. These are required for owner inventory and for processing of any utility rebate forms. Utility rebates require the model and serial numbers associated with a given unit number to match in case the job is spot checked prior to issuing a rebate

1.11 CODES, REGULATIONS AND ORDINANCES

- A. All work shall comply with the current applicable local, state and federal codes and ordinances. Follow recommended practices as set down by ASME, SMACNA, ASHRAE, NFPA, applicable Building Code, applicable Mechanical Code, applicable Plumbing Code, National Electrical Code (NEC), AGA, ADA AND OSHA, as they apply to this project, except in cases where local statutes govern. The contractor shall verify with the latest adopted local codes, ordinances and amendments that apply to this project with the authority having jurisdiction. **PROVIDE LOCKING REFRIGERATION ACCESS PORT CAPS FOR ALL EQUIPMENT WITH REFRIGERANT LOCATED OUTDOORS ON GROUND OR ON ROOF.**
- B. In cases of difference between Building Codes, State Laws, Local Ordinances and Industry Standards and the Contract Documents, each Subcontractor shall promptly notify the Architect in writing of any such difference, as applicable to his work.
- 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.
- D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building codes, State laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

1.12 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

- A. **All equipment and materials shall be protected from physical, moisture absorption, metallic corrosion and weather damage from the time of delivery until completion of the project. This includes erection of temporary shelters and covering items in the building with protective covering. Store items subject to moisture damage such as controls in dry, heated space. Failure to comply with the above to the satisfaction of the Owner/Architect will be sufficient cause for the rejection of the equipment or material in question. Upon such rejection, the damaged equipment or material will be completely replaced with new by the Contractor at no charge to the Owner.**
- B. **Provide covers on all ends and openings of pipes, conduits, ducts, etc. to keep out insects, dirt, dust and debris during entire construction process. This includes properly covering unassembled ductwork, etc. stored on jobsite prior to installation.**

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- C. The Manufacturer's directions are to be followed from delivery, storage, protection and installation of equipment and materials. Notify the Architect in writing of conflicts between requirements of Contract Documents and manufacturer's direction.
- D. Large pieces of equipment which are too large to permit access through doors, stairways or access opening shall be placed in the space before enclosing the structure. After equipment is placed, it shall be thoroughly protected from damage.

1.13 CLEAN-UP

- A. Remove debris and waste materials from within the construction areas and transport off-site, daily.
- B. Keep the construction area clean, free from hazard, and orderly arranged.
- C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.
- D. Dispose of waste materials in accordance with all regulations which govern.
- E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.
- F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.
- G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Unless otherwise indicated, provide only new equipment and materials.
- B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.
- C. All materials furnished under these specifications shall be the standard product of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.
- D. **GUARANTEE**
 - 1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical, HVAC, Plumbing and Fire Protection Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents. **In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect, and shall remain in effect for a period of TEN (10) YEARS thereafter.**

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2. All materials, items of equipment and workmanship furnished under each Section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other system resulting from this failure.
3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.
5. Additional extended guarantee's required for work on this project. The additions and/or extensions to the standard one year guarantee previously described are to be provided in writing, by the manufacturer or an approved insurance underwriter. The guarantee is to cover all parts and/or labor as specified below.

Master Extended Guarantee List:

- a. All comfort air conditioning and heat pump compressors are to have an additional four (4) year parts only guarantee. (Non-prorated)
6. Furnish, before the final payment is made, a written guarantee covering the above requirements.
7. Additional/extended guarantees listed above are Non-negotiable, and can't be amended through the submittal process.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

- A. The Contractor shall notify the General Contractor and other Subcontractors in ample time of the location of all chases, sleeves and openings required in the construction for the proper installation of his work. The Contractor shall do all core drilling of individual holes and all cutting for his work except square or rectangular openings in the structural slabs which shall be cut by the Contractor at locations shown on the drawings. In no case, however, shall a beam or column be cut without the approval of the Project Structural Engineer.
- B. On completion of this work or as work progresses the Contractor shall make all repairs and do all patching required as a result of the work under this contract. All patching shall be performed in a manner that will restore the surrounding work to its original conditions and to the satisfaction of the Owner.
- C. Any cutting and patching necessary as a result of the Contractor's failure to notify the General Contractor of all the required openings shall be at the expense of the Contractor.

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3.02 OBLIGATIONS/RESPONSIBILITIES

- A. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.
- B. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures, and for coordinating all portions of the work under his Contract.
- C. The Contractor shall provide, without extra charge, all incidental items required as a part of the work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.

3.03 TESTS AND INSPECTIONS

- A. Schedule, obtain, and pay for all fees and/or services required by local authorities and by these specifications, to test the mechanical systems as specified in these specifications.
- B. Request for Tests: Notify the Architect a minimum of 24 hours in advance of tests. In the event the Architect does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.
- C. Deficiencies: Immediately correct all deficiencies which are evidenced during the test and repeat test until system is approved. Do not cover or conceal piping, equipment or other portions of the mechanical installations until satisfactory tests are made and approved.
- D. Operating Tests: Upon request from the Architect, place the entire mechanical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.
- E. Log of Tests: The Contractor shall set up a testing log form to be kept at the job site with the record drawings. All tests shall have pertinent data logged at the time of testing. Pertinent data is to include: date, time, description, personnel, system tested (and extent), test conditions, test results, etc.
- F. Completion: Upon completion of the mechanical installation, demonstrate to the Architect's satisfaction that the systems have been installed in a satisfactory manner in accordance with the plans, specifications, and applicable codes. Demonstrate dynamic operation of all systems. Show that all controls are operable and are properly adjusted in accordance with the requirements of the final systems balance, that all systems are properly balanced, that all equipment operates properly, that filters and strainers are clean, and that all components of all systems are installed and adjusted for proper operation.
 - 1. Prior to final inspection, all work under this Division to be completed, insure all equipment is operational and final testing and balance reports have been submitted and approved.

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3.04 OPERATING INSTRUCTIONS

- A. Prior to final acceptance, instruct an authorized representative of the Owner on the proper operation and maintenance of all mechanical systems, equipment, and controls under this contract. Make available a qualified technician for each component of the installation for this instruction. Give these operation instructions after the operation and maintenance manuals have been furnished to the Owner. Submit written certification, signed by the Contractor, and an authorized representative of the Owner, that this has been completed.

3.05 COORDINATION OF WORK

- A. Each Contractor shall compare his Drawings and Specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, all trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Each Contractor shall coordinate the location of his systems so that all outside air intakes are located in such a way as to prevent cross-contamination from plumbing vents, flue pipes, exhaust fans, etc. Such a distance shall be not less than 10 feet.
- C. Locations of conduit, ducts, piping, sprinkler heads and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of system shall be determined prior to fabrication or installation. Coordinate routing of major electrical conduits with Electrical Contractor prior to fabrication of ductwork and piping.
- D. Offsets and changes of direction in all conduit, ducts and piping systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.
- E. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems and equipment, as determined by the Architect.
- F. **The HVAC, Plumbing and Fire Protection Subcontractors shall verify with Electrical Subcontractor the available electrical characteristics for all motors and equipment before ordering and submitting of respective gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**
- G. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.
- H. Mechanical Contractor and Controls Contractor shall coordinate all requirements of equipment and controls to insure a fully operational system.

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- I. Coordinate all plumbing rough-in through floor(s) with structural concrete TEE's/structural steel. Do not pass through stem of TEE's.

3.06 OPERATION AND MAINTENANCE MANUALS

- A. Provide one (1) Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records
- B. Operating Sequence and Procedures:
 1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter. Also, include a copy of System Balancing Report.
 2. Typewritten Operating procedures: Write procedures for start-up, operation, and shutdown.
 - a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.
 - b. Shutdown Procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instruction in that order.
- C. Maintenance Instructions:
 1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.
- D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide nearest manufacturers' representatives name, address and phone number.
- E. Shop Drawings: Provide a copy of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturers' brochures or properly identified in a separate subsection.
- F. Spare Parts Lists: Include a list of all equipment furnished for project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or system. Properly identify each part by part number and manufacturer.
- G. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format,

3.07 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical or electrical equipment is operable and it is the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. **All HVAC equipment shall be shut down when painting, sanding and similar construction operations detrimental to the equipment are being done.** The warranty period shall, however, not commence until such time as the equipment is operated

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solely for the benefit of the Owner at his request or as listed in 'C'. Contractor shall clean any ductwork and equipment that is dirty due to equipment operation or improper protection.

- B. Any units that are operated during construction shall have filter media (Fiberbond Dual-Ply DustLok Media) placed over the exterior of return air grilles. Media shall be changed as frequently as required to keep ductwork clean.**
- C. Regardless of whether or not the equipment has been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust the equipment and complete all punch list items before final acceptance by the Owner. The day following final acceptance by the Owner will be the start date of the warranty period.

3.08 RECORD FOR OWNER

- A. Each Contractor shall accumulate and bind in an "Operating and Maintenance" manual the following data to be presented to the Owner at the completion of the Project.
 - 1. All warranties and guarantees and manufacturer's instruction on equipment and material covered by the contract.
 - 2. Approved equipment brochures, wiring diagrams and control diagrams.
 - 3. Copies of approved shop diagrams.
 - 4. Operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
 - 5. Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.
 - 6. Valve tag charts and diagrams herein before specified.
 - 7. HVAC balance and test results.
 - 8. HVAC equipment start-up forms that include model and serial numbers of each piece of mechanical equipment installed, by unit mark number. For split units provide this information for all components.
 - 9. "As-Built" Drawings as specified under "Construction Drawings" (these are not to be bound in the O&M Manual).
- B. Provide reduced set of record drawing (11 x 17) indicating location and mark number of all mechanical equipment.

3.09 SITE OBSERVATION

- A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.
- B. It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense.**

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- C. The final acceptance of the work will be made jointly by the Architect and the Owner.

3.10 MECHANICAL/ELECTRICAL

- A. **THIS IS TO BE DONE PRIOR TO SUBMITTING HVAC EQUIPMENT.** Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for actual equipment (HETD's, RTU's, AHU's, CU's, HP's, HRU's, Airhawks, AFU's, MAU's, etc) being installed. Reference chart at end of section. This is for Contractor coordination purposes.

MEP/ENERGY CONSULTANTS



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FIRM F-4095

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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

- A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.
- B. 2 Submittal CATEGORIES (Reference Specifications)
 - a. Not required unless deviating from specification
 - b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:

For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures

Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:

Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

- C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.
- D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

- a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

- b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

RESTROOM BUILDING

- E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.
- F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.
- G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.
- H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."
- I. Call before submitting a written RFI.
- J. All formal Job emails must come from Architect.
- K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

- A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.
- B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.
- E. Schedule and Details sheets will not be released.

MEP/ENERGY CONSULTANTS



SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

COMMISSIONING • FIELD INVESTIGATIONS

The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph: _____

Drawings and Details Affected: _____

Proposed Substitution/Description: _____

Installer's Name: _____

Manufacturer's name: _____

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____ # of pages including cover)

Why is Substitution Being Submitted?

- ☐ Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
- ☐ Specified product is not available. Explain in detail as attachment.
- ☐ Cost Savings to Owner. Indicate comparative cost analysis as attachment.
- ☐ Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

- A. Does substitution affect dimensions shown on drawings? ☐ No ☐ Yes
- B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐ No ☐ Yes
- C. What affect does substitution have on other trades?
- D. Differences between proposed substitution and specified item?
- E. Indicate how proposed substitution meets LEED requirements. (if applicable)
- F. Manufacturer's guarantees of proposed and specified items are:
- ☐ Same ☐ Different (explain on attachment)

The Contractor and Subcontractor certifies:

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

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

For A/E Use: SR# _____

- ☐ Accepted ☐ Accepted as Noted
- ☐ Not Accepted ☐ Received Too Late
- ☐ Incomplete Information
- ☐ No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:

- ☐ FILE ☐ OWNER ☐ CONTRACTOR
- ☐ ENGINEER ☐ _____



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Round Rock, Texas 78664
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SECTION 20 01 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products, and methods of execution which are typical throughout the mechanical work of this project. Additional requirements for the specific systems will be found in the sections specifying those systems, and supersede these requirements.
- B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 JOB CONDITIONS

- A. Obtain approval from Architect prior to cutting any structural elements or furring members.
- B. Structural Interferences: Should structural members prevent the installation of piping, ducting or equipment, notify the Architect before proceeding.
- C. Consider minor changes in position of equipment, piping, or ducting, as part of the contract at no additional cost to the Owner.
- D. Coordinate with Structural and Architectural work to determine acceptable locations for sleeves and supports which are required but may not be specifically shown on the plans. SCHEDULE INSTALLATION OF SLEEVES AND SPECIAL SUPPORTS IN MANNER TIMELY TO THE WORK OF OTHER CRAFT. Anticipate minor offsets necessary for proper coordination with other work, and reroute systems appropriately.
- E. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Civil and Electrical Drawings where such drawings affect his work.

1.03 DIMENSION AND FIT

- A. Cut materials accurately from measurements taken on the JOB SITE.
- B. Do not spring or bend pipe to fit conditions or make up joints.

1.04 INTERFERENCES

- A. Interferences between piping and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed.
 - 1. Building Lines
 - 2. Structural Members
 - 3. Soil and Drain Piping
 - 4. Vent Piping

RESTROOM BUILDING

5. Refrigerant Piping
6. Supply, Return, Ductwork
7. Exhaust Ductwork
8. Domestic Hot and Cold Water Piping
9. Electrical Conduit
10. Fire Protection Piping

1.05 SERVICEABILITY OF PRODUCTS

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of piping, ductwork, equipment, coils, system components, and other products to allow proper service of all items requiring periodic maintenance or replacement.
- C. **Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.**

1.06 ACCESSIBILITY OF PRODUCTS

- A. Arrange all work to provide permanent, convenient, and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.
- B. Provide access doors in ceilings, walls, floors, etc., for access to traps, valves, dampers, automatic devices, and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.07 ROUTING

- A. Route all pipelines and ductwork parallel with building lines, and as high as possible, except where under ground or shown otherwise on the plan.
- B. Route piping and ducts to clear all doors, windows, and other openings and to avoid all other pipes and ducts, light fixtures, and similar products.
- C. Conceal all pipes and ducts where routed through finished areas, unless authorized by Architect or otherwise indicated on plans.

PART 2 - PRODUCTS

2.01 MATERIAL PRODUCTS

- A. Provide all products new, unused, and undamaged, of standard manufacture, and of latest design and best quality. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

RESTROOM BUILDING

- B. When a manufacturer's name appears in these specifications or schedule, it is not to be construed that the manufacturer's material does not have to meet the full requirements of the specifications or that his standard catalogue item will be acceptable.
 - C. All equipment installed on this project shall have local representation, local factory authorized service and local stock of repair parts.
 - D. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.
- 2.02 Where more than one type of material (i.e., cast iron or PVC) is specified, the Contractor may choose one type; however, he must state which type of material he proposes to use in his submittal. **ONLY ONE TYPE OF MATERIAL MAY BE USED IN A SPECIFIC PIPING SYSTEM, UNLESS SPECIFICALLY NOTED OTHERWISE. (I.E. WHEN DIFFERENT SIZES OF THE SAME TYPE SYSTEM REQUIRE DIFFERENT MATERIALS PER SPECIFICATIONS.)**

2.03 PIPE AND FITTINGS

- A. Steel Pipe: **All steel piping and fittings are to be domestically manufactured (USA).**
 - 1. **PROVIDE DOCUMENTATION IN SUBMITTAL STATING LOCATION OF MANUFACTURING.**
 - 2. Threaded: Schedule 40, ASTM A53 grade B or ASTM A120, American Standard pipe thread. Pipe 2" and under to be made up with threaded fittings.
 - 3. Welded: Schedule 40 black, ASTM A53 grade B or ASTM A120, ANSI B16 butt weld fittings of type and wall thickness to suit pipe. Weld-O-Lets and Thread-O-Lets may be used on pipe 2-1/2" and larger where branch is a minimum of two pipe sizes smaller than main. Pipe 2-1/2" and over to be made up with welded fittings. Pipe 2" and under to be made up with threaded fittings.
 - 4. Grooved Pipe: Schedule 40 ASTM A120 or ASTM A53 grade. Standard cut or rolled groove to coupling manufacturer's specifications. Do not use in systems exceeding 200° F. operating temperature.
 - a. Couplings: Standard weight with gasket selected by manufacturer for service intended.
 - b. Fittings: Full flow malleable iron, ductile iron or steel.
 - c. Submit calculations of expansion allowance of joints and obtain approval prior to eliminating any special expansion compensators, swing joints, flexible connections, or vibration isolators.
 - d. Manufacturers: Victaulic or Gruvlok.
- B. Copper pipe:
 - 1. Type "K" or "L" hard drawn copper with wrought copper fittings with openings machined to accurate capillary fit for the pipe. Pipe to conform to Standard Specifications for copper water tube. Type 'M' may only be used for A/C condensate drain lines.

RESTROOM BUILDING

2. Use "lead free" (0.00% lead content) solder for all domestic water piping. Submittal on the product to be used must include this information. Lead free solder to conform to ASTM B 32 and flux to conform to ASTM B 813. Soldered joints must be done in accordance with ASTM B 828. Lead free shall mean a chemical composition equal to or less than 0.2 percent lead.
 3. Solder joints using 50/50 lead tin solder for systems operating below 180° F.
 4. Solder joints using 430 silver solder for systems operating at 180° F. or above.
- C. Domestic Copper Pipe (2" and larger): (Contractor Option)
1. Copper tubing systems from two inches (2") through six inches (6") shall be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure-responsive gasket along with grooved end copper fittings.
 2. All copper tubing shall be prepared in accordance with the manufacturer's published specifications.
 3. Couplings - Coupling for copper shall consist of cast ductile iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts and bolts to secure unit together.
 - a. Housings - Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) with a copper alkyd enamel paint coating.
 - b. Gasket - Gaskets shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the copper tube size (CTS) outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000.
 - c. Water Service - Gaskets supplied for water services from -30° F to +230° F shall be a Grade "E" EPDM compound, with copper color code, molded of materials conforming to ASTM D-2000, designation 2CA615A15B44F17Z, recommended for hot water service within the specified temperature range.
 4. Flanged Connections: Shall be, engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer to supply standard flange bolts. Flange casting shall be as in 3, a. above with a corresponding gasket as in 3, b.
 5. Fittings - Fittings shall be full flow copper fittings with grooves designed to accept grooved end couplings.
 - a. Standard fittings shall be two inch (2") through four inch (4") copper per ASTM B-75 alloy C12200; five inch (5") through six inch (6") bronze sand castings per ASTM B-584-87 copper alloy CDA 844 (81-3-7-9).
 6. Butterfly Valves – Lug style, grooved end butterfly valves are to be rated for bi-directional dead end service to the full working pressure of the valve with the down stream flange removed.
 - a. 2 ½-6" valves shall have either lever lock handles or gear operators. Valves in 2 ½" or 3" sizes may have two-position handle as per service requirements and manufacturer's recommendations.

RESTROOM BUILDING

- 1) Valve housing shall be bronze per CDA-836 (85-5-5-5).
 - 2) Disc shall be aluminum bronze or ductile iron.
 - 3) Operator bracket shall be steel-black enamel coated.
 - 4) Operator - Two (2) position detent or manual lever lock shall be steel-black enamel coated.
 - 5) Seat to be molded to the body of the valve for bi-directional dead end service
7. Tube Preparation: Copper tube shall be to ASTM B-88 (drawn tubing) and prepared in accordance with the latest published manufacturer's specifications, as applicable. Pressure ratings and end loads for roll grooved copper tubing are based upon test on copper tube prepared in accordance with manufacturer's specifications using manufacturer's approved rolled grooving tool for grooving copper tube.
8. Assembly: Couplings, fittings, adapters and tubing shall be assembled in accordance with the latest published instructions from the manufacturer for the particular product installed.
9. Reference hanger spacing in specification. In addition, use the following recommendations for support installation:
- a. Copper tubing joined with grooved type couplings requires support to carry the weight of tubing and equipment. The support or hanging method must be such as to eliminate undue stresses on joints, tubing and other components.
 - b. The support system for mechanical grooved type tubing couplings must consider some of the special requirements of these couplings.

2.04 VALVES

- A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 psig steam or 150 psig W.O.G. All valves on insulated lines to have extended handles to allow operation without disturbing insulation seal.
- B. Manufacturer: Nibco, KITZ, Jenkins, Milwaukee, Stockham, other recognized manufacturer of equal reliability.
- C. Gate Valves, 2½" and Larger: Iron body, bronze trim, rising stem, flanged.
- D. Globe Valve 2" and Smaller: Teflon disc, bronze body, bronze trim.
- E. Ball Valves 3" and Smaller: Brass or bronze body, virgin TFE seat rings, blow-out proof stem, reinforced thrust washer, ¼ turn full open/full close, FULL PORT, CSA-ULFM approval.
- F. Globe Valve 2½" and Larger: Iron body, bronze trim, Buna-N disc, flanged, bronze disc hot water, Buna-N disc cold water.
- G. Swing Check Valves 2" and Smaller: Bronze body, horizontal swing, Y-pattern, renewable disc.

RESTROOM BUILDING

- H. Swing Check Valves 2½" and Larger: Iron body, horizontal swing, bolted bonnet, renewable seat and disc, flanged, non-slam type.
- I. **Butterfly Valves: Reference Section 2.03, C. above.**
- J. Drain Valves: Hose end gate valve or gate valves with hose connection. Do not use sillcocks in lieu of drain valves.
- K. Valves Specified Elsewhere: Provide special valves such as motor operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.
- L. **USE FULL PORT BALL VALVES RATED FOR SERVICE INTENDED FOR ALL ISOLATION VALVES THREE INCHES (3") AND SMALLER.**

2.05 BALANCING VALVES

- A. Provide balancing valves for all cooling and heating flows and at all pump discharge lines. Provide balancing valves for all potable hot/tempered water recirculation systems and at TMW's as required by manufacturers written instructions.
- B. Valves sized for maximum 1 pound pressure drop at design flow with valve wide open. Submit schedule of balancing valves indicating sizes, flow ranges and pressure drop curves.
- C. Valves, rated at not less than 150 psi, furnished with three self-lubricating bronze or teflon-coated stainless steel bushings with shaft seals at each bushing; seals to be hard back resilient type and shall be field replaceable; discs shall be bronze, aluminum-bronze, or semi-steel with welded nickel edge.
- D. Valves 4" and smaller insulated with removable foam polyurethane Dry Cap. Series 400.
- E. Valve 2½" through 6" shall be lever operated. Butterfly valves, lug body indicating locking type with adjustable memory stop, may be used at Contractors option at each location where gate valves or globe valve is indicated on water line 2½" and larger.
- F. On valves 2" and smaller, use Flow Set balancing valves system consisting of: 300 lb. rate flow measuring bronze body ball valve with integral venturi and temperature and pressure taps; flow setting 300 lb. butterfly valve assembly with stainless steel disc and Viton seats dual-core temperature/pressure test port and external lockable memory stop. Furnish valves with insulation sleeve for ease of access to temperature/pressure ports and to allow adjustments of valve handles without removing insulation. Manufacturer: FlowSet by Olympic Valve, Inc. At the Contractor's option, use Presso B-Plus balancing valves with extension handle and extension P/T plugs.
- G. Manufacturers: DeZurik, Olympic Valve, Inc., Jenkins, Nibco, B & G, Hammond, Presso or approved equal.

2.06 UNIONS

- A. Provide unions adjacent to all tanks and equipment and where required for disconnect and maintenance of equipment.
- B. Union for Steel Pipe: Ground joint malleable iron.
- C. Union for Copper Pipe: All brass.

RESTROOM BUILDING

- D. Union Between Dissimilar Metals: Dielectric Union designed and advertised to be unaffected by heat, cold or fluid in pipe. EPCO or approved equal.

2.07 MISCELLANEOUS

- A. Escutcheons: Nickel or chrome plate with screws or springs for holding plate in position.
- B. Automatic Air Vents: Hoffman #79, Marsh or equal.
- C. Gaskets: Gaskets 1/16 inch thick for all pipe sizes 10 inches and smaller and 1/8 inch thick for all pipe sizes 12 inches and larger. Gaskets to be ring type between raised face flanges and full face type between flat face flanges with punched bolt holes and pipe opening. Gasket material shall be suitable for the service intended and shall be installed as recommended by the manufacturer. Manufacturer: Crane, John-Manville, or equal.
- D. Strainers: Cast iron or bronze body basket or wye type strainers provided with ½" valved drain and a ¼" air vent cock, unless the strainer design is devoid of air pockets. Strainers shall have removable cylindrical or conical screens of nickel, copper, or brass and suitable flanges or tapings to connect with the piping they serve. Strainers 2½" and larger shall be provided with flanged covers. The free area of each screen shall not be less than three (3) times the area of the strainer inlet and shall be suitable for the service intended. Manufacturers: Crane, McAlear, Sarco or Armstrong.

2.08 MECHANICAL SUPPORTING DEVICES

- A. General:
 - 1. Securely fasten all mechanical work to the structure to prevent hazard to human life and limb, and to prevent damage to products of construction under all conditions of operation.
- B. Pipe Supports:
 - 1. Single Pipes:
 - a. Support all horizontal runs of steel, copper pipe under 2" and all cast-iron soil pipe on suitable hangers spaced not more than 5 feet on centers. Support all steel, and copper piping 2" and larger not more than 10 feet on centers. Support all PVC piping not more than 4 feet on center. Support piping in a manner to prevent binding, undue swing, and the transmission of vibration to the structure.
 - b. Support single pipes from clevis hangers equal to Anvil fig. 260. Install hangers for insulated piping outside the insulation using high density section of insulation and sheet metal shield or saddle. Provide copper plated hangers in contact with copper pipe.
 - 2. Trapeze Hangers: Where pipes are clustered, parallel, and in same plane, they may be supported by trapeze hangers. Provide rods and angle-irons sized to suit load imposed. Minimum channel length to be six inches (6"), maximum rod spacing to be twenty-four inches (24") on center. Piping to be securely attached to trapeze hangers. Provide sheetmetal shield or saddle for all insulated piping running horizontally.

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3. Piping on Walls: Secure with hook-plates, clips or fabricated steel brackets.
4. Supports from Steel Beams and Similar Construction: Use appropriate beam clamps.
5. Provide inserts for poured concrete and expansion bolts for pre-cast slabs.
6. Guide and anchor piping where necessary to control expansion and contraction. Provide supports and hangers with non-corrosive and rust-resistant finish. Galvanize or plate hanger rods after threading. Hangers other than those specified not permitted. **USE ONLY GALVANIZED HANGERS AND HANGER RODS FOR ALL PIPING IN CRAWL SPACE.**
7. Provide inserts for poured concrete and expansion bolts for pre-cast slabs. Use HiltiDrop-in Anchor or Kwik Bolt II Stud Anchor System. Verify allowable place of anchors with Structural Engineer.
8. Provide pipe supports according to the following schedule:

PIPE SIZE - INCHES	ROD SIZE - INCHES
½" through 2"	3/8"
2½" through 3"	1/2"
4" through 6"	5/8"
8" through 12"	3/4"

9. Manufacturers: Anvil International, C&P, Fee and Mason, Elcen or SuperStrut.
- C. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for piping 2-1/2" and smaller. For piping over 2-1/2", up to and including 8" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All pipe stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Walk board to be a minimum of 3" larger on each side than support. Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 6"). Provide supports for piping under 2" at six feet on center. Provide supports for piping 2" and over at eight feet on center. **PIPE PROP will not be acceptable.**
- D. Ductwork Support: Refer to Section 23 30 00-Air Distribution.
- E. Inserts: Provide all inserts required for installation of horizontal piping. In poured concrete provide wrought steel or malleable iron and adjustable type. Where expansion bolts are necessary to secure piping or equipment, use malleable iron type with expansion case, to be inserted by drilling concrete. Power driven inserts not permitted for supporting piping to ceiling.
- F. Miscellaneous Iron and Steel:
1. Provide all steel supports and hangers to support all equipment or materials unless noted otherwise.
 2. All work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and rigidly constructed in a manner to withstand anticipated loads.

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3. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be performed by experienced metal-working mechanics. Members shall be straight and true and accurately fitted.
4. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades.
5. Members shall be generally welded except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.
6. All shop fabricated iron and steel work shall be cleaned and dried and given two (2) coats of weatherproof primer paint on all surfaces and in all openings and crevices.

2.09 ACCESS DOORS

- A. Doors shall be Karp, Inland Steel Products, Milcor, Miami or Walsh-Hannon, constructed of steel with primer coat of rust inhibitive paint, and continuous piano hinge. Doors shall be key operated with flush operated cylinders, keyed alike. Key lock system shall be coordinated with the Owner and shall be approved by the Architect. Provide six (6) keys of type used for access panels for Owner's use. Obtain receipt of key delivery and submit to Architect for record.
 1. Suspended Lath and Plaster Ceilings - Style: "M" with 16 gauge frame, 14 gauge panel.
 2. Masonry Non-Rated Walls - Style: "M" with 16 gauge frame, 14 gauge panel.
 3. Masonry Fire Rated Walls - Fire rated with UL, ½ hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel.
 4. For access doors larger than 16" in either direction, provide two (2) locksets.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTING

- A. Provide equipment concrete pads, treated support runners, roof curb supports, mounting accessories, supports, hanger expansion joints, adapters and any other appurtenances to adapt fixtures and equipment supplied to the conditions of use.
- B. Provide vibration eliminators as specified (if not specified elsewhere use vibration eliminators recommended by equipment manufacturer) at all pieces of equipment subject to vibration. (Exception; curb mounted equipment does not require vibration isolator rails except when specifically scheduled).
- C. Independently support piping and ductwork at equipment so that no weight is supported by the equipment.
- D. Securely fasten fixtures and equipment to the building structure in accordance with manufacturer's recommendation.
- E. Provide steel base plates for floor mounted fixtures and equipment to distribute the weight so that the floor load is not more than 100 lbs. psf, unless special structural reinforcement is submitted for approval.

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- F. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates of at least 1/8 x 10 inch sheet metal or 2 x 10 inch fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.
- G. Electrical conduit shall not be hung from equipment or plumbing piping.

3.02 SLEEVES

- A. Provide sleeves as required where pipes pass through walls, floors, or ceilings. Make sleeves as follows:
 - 1. In non-fire rated bearing walls, foundations, masonry or concrete walls and floors, use schedule 40 black steel pipe.
 - 2. In non-rated construction, use minimum 20 gauge galvanized sheetmetal.
 - 3. In fire rated walls, floors and assemblies, install sleeves as required by UL System Number.
- B. In non fire rated areas install sleeves flush with surfaces. In mechanical rooms or any wet floor where seepage may occur, install sleeve 1 inch above floor and caulk. Caulk both sides of penetration using UL listed one part firestop synthetic elastomer sealant, flexible at normal working temperatures, having smoke developed 50, fuel contributed 50, and flame spread 25 rating. Install thickness per manufacturer's recommendation. Manufacturer: Dow Corning FireStop 2000 Sealant, Flame Stop V, 3M: CP-25.
- C. Waterproof all piping and sleeves through building exterior skin, including walls, roofs and interior floor penetrations to prevent leakage. Coordinate with the Architect on caulk material to use at exterior.
- D. Size sleeves for cold piping to allow for continuous insulation through sleeve.

3.03 SEALING AND FIREPROOFING

- A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**
 - 1. Only materials tested in the specific UL System Number may be used.
 - a. Wrap Strip (UL System No. WL 5001): Nominal 1/4" thick by 2" wide intumescent elastomeric material. Manufacturer: 3M Type FS-195.
 - 1) Use one (1) wrap strip for up to one inch (1") thickness insulation.
 - 2) Use two (2) wrap strips for 1-1/2" inch and larger thickness insulation.

- b. Caulk Manufacturer:
 - 1) 3M Type CP-25 WB+ for all assemblies requiring 3M caulk.
 - 2) For WL3045 and 3046 use Hilti FS611A Sealant.
 - c. Steel Sleeve (Stud Wall) (UL System 1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum 2" lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus 1" such that, when installed, the ends of the sleeve will project approximately ½" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with pipe) to be 2 to 2-1/2" larger than the outside diameter of pipe such that, when the steel sleeve is installed, a 1 to 1-1/4" annular space will be present between the steel sleeve and the pipe around the entire circumference of the pipe. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.
 - d. Steel Sleeve (Concrete or Block Wall): For cables, provide sleeve cast in floor/wall or mortared into CMU wall; optional sleeve for UL System No. CAJ1175.
 - e. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.
2. Wire/Cables:
- a. For Gypsum Frame Wall (Single Cable): Fireproof per UL System No. WL3001. Opening for cable to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" inch larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).
 - b. For Gypsum Frame Wall (Multiple Cables): Use UL System No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.
 - c. For Concrete Walls/Floors or CMU Walls (Single or Multiple Cables): Fireproof per UL System No. CAJ3030. Cables to be a minimum ten percent (10%), maximum thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.
3. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies.
4. Materials used in firestop systems shall be installed in accordance with the manufacturer's instructions, provided with materials for specific UL System Number.

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- 5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.
- B. Manufacturers: 3M, Metacaulk, Hilti, BioFireShield, STI or equal.
- C. In non-rated walls identified for sound insulation, provide 1/2" space between pipe and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.
- D. **Final condition to prevent passage of fire, smoke, noxious gas and water.**
- E. For non-rated mechanical/electrical room walls: Seal all piping and ductwork passing through walls, floors and ceilings with 3M caulk, Type CP-25+.
- F. Submit UL numbers and details for type of penetrations and materials to be used. All penetrations in fire rated walls, floors and ceilings must be installed per a UL listed detail specified for the application.
- G. **Seal both sides of all floor penetrations into crawl space on both sides to prevent air and water migration.**

3.04 WATERPROOFING AND COUNTERFLASHING

- A. Provide and install all counterflashing of all conduit, pipe or duct and equipment which penetrates roofs, walls and other weather barrier surfaces. Metal Roofing Contractor shall provide and install all curbs and counter flashing for all metal roof penetrations. Verify detail with Architect before installation.
- B. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at contractor's expense, to Architect's satisfaction.
- C. Conduits, pipes or ducts passing through slabs shall have the sleeve extended above floors to retain any water and the space between the conduit, pipe or duct and sleeve caulked with lead wool. The top shall be sealed with lead and the bottom shall be sealed with monolastic caulking compound.
- D. All waterproofing, flashing and counterflashing shall be provided and installed by the Roofing Contractor and shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect.
- E. Slope all ducts to wall louvers to drain toward louvers. Provide continuous sleeve thru wall and seal all joints.
- F. **All piping and conduit penetrations through exterior walls shall be sealed on both side of drain plane and at exterior finished wall surface to prevent moisture intrusion.**

3.05 LABELING AND TAGGING

- A. Tag all valves with minimum 1/16" thick heat resistant laminated dark plastic labels engraved with readily legible white lettering 1/4" high indicating fluid in pipe and a "V" (valve) number (e.g. V-22). Securely fasten to the valve stem or bonnet with beaded chain. Provide an aluminum valve chart and frame with glass cover for typewritten valve chart. Install where directed. Coordinate valve numbers with mechanical contractor to avoid duplication. Refer to Section 20 00 00, and Manuals.

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- B. Label all equipment with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/2" high and fastened in place with rivets, screws or adhesive backing. Example "WH-1, AHU-1, etc." If items are not specifically listed on the schedules, consult the Architect concerning designation to use. Refer to Section 20 00 00. Label all equipment served by emergency electrical panels with red labels.
- C. Label all thermostats/sensors with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/4" high and fastened in place with rivets, screws or adhesive backing. Label is to correspond to rooftop and/or air-handling units.
- D. Provide access panel markers (minimum 1/16" thick laminated plastic type with engraved lettering) to indicate ceiling tile to be used for access for all A/C equipment, terminal units and plumbing shut-off valves. Use light green for plumbing and light blue for A/C equipment. Label to be attached to ceiling grid with rivets, screws or adhesive backing. Example, "AHU-3A" access.
- E. Manufacturer: Seton Pipe Marking Products, MSI (Marketing Services, Inc.) or equal.

3.06 TYPICAL PIPING

- A. Provide insulating couplings or unions to prevent electrolysis between dissimilar metals when use of dissimilar metals cannot be avoided in one system.
- B. Close all openings in pipes with appropriate caps, plugs, or covers during storage and progress of the work to preclude introduction of contaminants.
- C. Arrange systems and locate valves so that either entire system or separate sections thereof may be drained for service. All service valves located no more than 24 inches above the ceiling and normally accessible from an 8 foot ladder.
- D. Provide valves and unions adjacent to all tanks, batteries of plumbing fixtures and equipment, for disconnect purposes. Install all valves with stems vertical wherever possible, and in no case with stems below the horizontal.
- E. Ream ends of all pipe to full diameter.
- F. Provide pipe anchors, swing joints, and expansion compensators as required to control the expansion of pipelines.
- G. Reduce pipe sizes using reducing tees or reducing fittings. Bushings not permitted except on tanks and similar equipment.
- H. Provide escutcheons on all pipes passing through walls, floors, and ceilings in finished areas where piping is in counters, closets or cabinets, and subject to view when doors are open. Cover the pipe sleeve and secure plate in position.
- I. Install hangers at each change in direction and within 2 feet at each elbow or tee. This requirement is mandatory.
- J. Pipe hooks, wire, chains or perforated metal shall not be used for pipe supports.
- K. Insulate hangers for copper pipe from piping with at least two layers of 12 mil Polyken 826 corrosion control tape.
- L. Install piping not to interfere with removal of equipment, ducts, and devices or block access to door or access openings.

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- M. Piping serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finished wall.
- N. Test all piping in accordance with accepted trade standards if not specified elsewhere.

3.07 THREADED PIPE

- A. Cut all threads true and of depth to make up properly without leaks.
- B. Make connections to show at least two threads and not more than four threads when tight.
- C. Make up joints with Teflon tape only as recommended by tape manufacturer, or as specified in specific piping sections.

3.08 AUTOMATIC (MANUAL) AIR VENTS

- A. Install at highest point of chilled and hot water system, at chilled and hot water coils and at points necessary to relieve air in piping. Provide shut-off valve to facilitate maintenance of air vent.
- B. Route 1/4" copper line from discharge of air vent to floor drain in mechanical room. Slope to drain.

3.09 PAINTING AND CODING

- A. Ductwork and Piping: Prime and paint all exposed angle braces, hanger rods or straps, damper rods, and quadrants with one coat aluminum paint after removing scale and rust. Prime and paint ductwork and piping exposed in finished rooms to match room finish. Prime and paint all black iron piping located outdoors or otherwise exposed to weather. Coordinate painting and color with Architectural paint specified elsewhere. All painting done by persons regularly employed at and skilled in that trade.
- B. Grilles, Registers, Etc.: Furnish all grilles, registers, etc., other than extruded aluminum or plastic with prime coat paint by manufacturer. Furnish all ceiling grilles, registers and diffusers with factory applied baked enamel to match ceiling tile. Paint all ductwork and/or conduit visible through registers, grilles and other openings with one coat of flat black paint to a point four feet (4') from opening on straight duct or around bend, whichever applies.
- C. Pipe Coding:
 - 1. Identify piping with pressure-sensitive coded pipe marker at piping adjacent to equipment, at intervals along all piping not to exceed 20' and at points where piping disappears into or emerges from floors, walls or ceiling. Secure both ends of marker with pressure sensitive tape with flow arrow on roll to indicate flow direction. Color code pipe markers and arrows indicating the liquid and/or use of the pipe.
 - 2. Code piping to the following schedule: (SUBMIT ALTERNATE CODING)

Cold Water	CW
Hot Water	HW
Hot Water Circulating	HWC
Hot Water Supply	HWS
Hot Water Return	HWR
Heat Pump Supply	HPS
Heat Pump Return	HPR
Sprinkler	SPKR
Condensate	Condensate

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3. Manufacturers: Seton Pipe Marking Products, MSI or equal.

END OF SECTION

SECTION 20 07 00 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products and methods of execution which relate to the insulation of ducts, pipes and other surfaces of the mechanical installation.
2. Insulation is provided for the following purposes:
 - a. Energy conservation
 - b. Control of condensation
 - c. Safety of operating personnel

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. Acoustical Lining Insulation Summary

1. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of air duct systems of sheet metal lined with fibrous glass duct liner, in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:
2. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below and internal air temperature not exceeding 250°F (121°C).
3. Duct liner products shall conform to the requirements of ASTM C1071. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
4. The manufacturer's product identification shall appear on the air stream surface.
5. Duct liner adhesive shall conform to the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
6. The finished duct system shall meet the requirements of NFPA 90A and 90B.
7. Duct dimensions shown on the plans are finished inside dimensions.

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8. Fabrication and installation shall conform to the requirements of the latest edition of the North American Insulation Manufacturers Association's *Fibrous Glass Duct Liner Standard* (hereinafter referred to as NAIMA FGDLS) or the Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standards - Metal and Flexible* (hereinafter referred to as SMACNA HVAC DCS) or the manufacturer's recommendations.

D. References

1. American Society of Testing and Materials(ASTM)
 - a. ASTM C1071
 - b. ASTM C916
 - c. ASTM G21
 - d. ASTM G22
 - e. ASTM C423
 - f. ASTM C518
2. National Fire Protection Association (NFPA)
 - a. NFPA 90A
 - b. NFPA 90B
 - c. NFPA 259
3. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - a. HVAC Duct Construction Standards Metal and Flexible (HVAC DCS)
4. North American Insulation Manufacturers Association (NAIMA)
 - a. Fibrous Glass Duct Liner Standard (FGDLS)
5. International Nonwovens & Disposables Association (INDA)
 - a. IST 80.6

E. Delivery, Storage and Handling

1. Deliver all materials and/or fabricated, insulated duct sections and fittings to the job site and store in a safe, dry place.
2. Protect materials from dust, dirt, moisture, and physical abuse before and during installation, startup and commissioning. Wet or contaminated duct liner shall be replaced.

PART 2 - PRODUCTS

2.01 FIRE RATING OF MATERIALS

- A. Provide all insulation products used above ground in buildings with burning characteristics not to exceed the following ratings according to NFPA 255-1972 "Method of Test of Surface Burning Characteristics of Building Materials": Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.
- B. Insulation specified for use underground and above ground away from the building, might have other burning characteristics. Use such products only where specifically required.

2.02 INSULATION

- A. TYPE "A": Pre-molded Fiberglass Piping Insulation:
 - 1. Jacket Type:
 - a. Thermal conductivity $K = 0.24$ at 100° F. mean temperature.
 - b. Factory applied kraft-reinforced vapor barrier flame retardant all service jacket and tape, with permeability rating - 0.02 perms.
 - c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.
 - d. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover.
 - e. Manufacturer: Owens-Corning Fiberglass, Certainteed, Knauf, Schuller/Manville AP-TPLUS.
- B. TYPE "B": Cellular Piping Insulation:
 - 1. Thermal conductivity $K = .27 @ 75^{\circ}$ F. mean temperature.
 - 2. Elastomeric thermal insulation with permeability rating of .17 perms.
 - 3. Temperature range from -40° F to 220° F.
 - 4. Insulation to meet 25/50 requirements for use in return air plenums
 - 5. Wall thickness as listed in Part 3 of this Section for size and use of piping.
 - 6. Install without slit when possible. All slits in insulation to be smooth. Insulation installed with jagged edges will be removed and replaced at no cost to Owner.
 - 7. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
 - 8. Manufacturers: Armacell Armaflex Type AP Pipe Insulation, Rubatex, Halstead, IMCOA.

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C. TYPE "C": Blanket Type Duct Wrap Fiberglass Insulation:

1. **The Contractor may use a 3/4, 1 or 1-1/2 pound density product with a minimum installed R-value of 6.0 if ductwork is within building insulation envelope or minimum R-value of 8.0 if installed outside of building insulation envelope.** Density, thickness and installed R-value to be clearly indicated on submittal.
2. Fiberglass duct wrap insulation is to have a factory FSK or FRK facing which acts as the vapor barrier. Maximum permeability rating is 0.02 perms.
3. Use only labeled Type UL181AP Aluminum Foil Tape a minimum of 3" wide and 7.4 mils thick "Venture Tape #1525CW" or "Shurtape #AF-982"). Maintain a complete vapor barrier throughout all ductwork insulation applications. Use spreader to completely seal tape to all joints or tears in vapor barrier, surface must be clean prior to installation.
4. Certainteed SoftTouch Duct Wrap with FSK facing or equal. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
5. Manufacturers: Knauf, Schuller/Manville, Certainteed or Owens-Corning.

D. TYPE "D": Rigid Fiberglass Board Insulation (DUCTBOARD SYSTEM)

1. **1-1/2" thick, Type 475 with a minimum R-value of 6.0 when inside building insulation envelope.**
2. **2" thick, Type 800 with a minimum R-value of 8.0 when outside building insulation envelope.**
3. Rigid board composed of resin bonded glass fibers faced with reinforced foil vapor barrier with permeability rating of .02 perms.
4. Meet UL181 test and classified as Class I Air Duct. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
5. Maximum operating temperature of 250° F.
6. Tape joints using heavy duty foil tape, UL181A labeled, 7.5 mils thick, 3 inches wide, FSK Facing Tape Venture or equal.
7. Manufacturers: Certainteed, Knauf, Schuller/Manville, Owens-Corning.

E. TYPE "E": Semi-rigid Fiberglass Insulation Board.

1. Semi-rigid glass fiber bonded insulation not affected by moisture, resistant to fungi and bacteria. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
2. Permit expansion and contraction of metal without cracking or shrinking.
3. Maximum operation temperatures of 850° F.
4. Manufacturers: Certainteed 850 Fiberglass Insulation, Knauf, Schuller/Manville, Owens-Corning.

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2.03 SOUND CONTROL

A. Lined Duct:

1. **Provide acoustically lined duct to attenuate and control the transfer of airborne sound and as duct insulation only when specifically indicated.**
2. Lining: Flexible fiberglass blanket type mat faced insulation with durable surface coating, bonded with thermosetting resin. Maximum flame spread index; 25. Maximum smoke developed index; 50. **Lining to have anti-microbial coating.** Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0. **1.5" thick, R-6 lining equal to CertainTeed ToughGard R-EP or ToughGard2 Textile Duct Liner.** R-8 for ducts located outside the building insulation envelope. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**
3. Air Friction Correction Factor 1.12 at 500 fpm or less.
4. Minimum sound absorption co-efficients as follows:

Thickness	Frequency					
	125	250	500	1000	2000	4000
1-1/2"	.17	.53	.87	.99	1.00	.95
5. All duct dimensions shown on drawings are net clear inside dimensions with duct liner. Install liner in compliance with requirements of NFPA 90A.
6. Manufacturers: Shuller, CertainTeed, Knauf or Owens-Corning.
7. All duct liner to be provided with tough abrasion resistant interior air side finish and antimicrobial coating.

2.04 INSULATED FITTING COVERS AND JACKETING

- A. High-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.
- B. Pre-cut curled jacketing, 30 mil. thickness. Sized to snugly fit pipe diameter with thickness of insulation specified.
- C. Joints and seams sealed with Perma-Weld Adhesive to form a complete vapor barrier for chilled water and domestic cold water systems. Use tack and tape for heating water and domestic hot water systems. Installation of adhesives, tacks and tape shall be per manufacturer's recommendations. Submit installation instructions with submittal of materials.
- D. Fitting Covers: Covers shall be pre-formed for fitting shape.
- E. Manufacturer: Schuller/Manville Zeston 2000, Owens-Corning Fiberglass, CertainTeed, Knauf or Proto.

2.05 CANVAS JACKETING

- A. Insulating Lagging Canvas: 8oz./sq. ft. minimum, 28 threads per inch minimum, Osaberg or equal.

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- B. Lagging Adhesive: Plastic synthetic resin emulsion adhesive; watertight, mildew resistant, fire retardant; Miracle LA69, Borden Aerosol or equal. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

2.06 METAL OR VINALUM JACKETING

- A. Material shall be minimum .016" thick aluminum jacket or vinalum .020" thick aluminum faced PVC jacket with integral factory applied vapor barrier.
- B. Elbows, fitting and valves shall be metal preformed fitting covers (no gores acceptable). Valves made from .020 metal. All valves ends and where insulation reduces shall have Pittsburgh seams.
 - 1. All straight line metal to be Z-locked jacket held in place with 3/4" wide aluminum bands at nine inches (9") on center with wing seals.
- C. All joints and seams shall be watertight with Childers CP-76 OR Foster 95-44.
- D. Manufacturer: "Strap-On" Childer Cawed Systems or equal.

2.07 COATINGS

- A. All coating to bear the UL label. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- B. On cold or dual service lines, use vapor barrier type coatings.

2.08 METAL SHIELDS (SADDLES)

- A. Metal Shields curved to fit up to midpoint of the insulated pipe.
- B. Metal shields shall be 16 gauge, twelve inches (12") long for pipes up to two inches (2") and 14 gauge, sixteen inches (16") long for piping 2-1/2" and larger.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION AND WORKING CONDITIONS

- A. Apply all insulation, fitting covers, mastics and sealants per manufacturer's recommendations.
- B. Do not apply insulation materials until all surfaces to be covered are clean and dry and all foreign materials such as rust, dirt, etc., are removed.
- C. Keep insulation clean and dry during installation and during the application of any finish.
- D. Do not install the insulation on pipe fittings, and pipe joints until the piping is tested and approved.
- E. Do not apply under conditions of excessive humidity or at temperatures below 50° F or above 100° F.

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3.02 TECHNIQUE FOR APPLICATION TO PIPES

- A. Close longitudinal joints of pipe insulation firmly and butt insulation sections firmly together.
- B. Neatly and smoothly adhere all laps and butt strips. Adhere three inch (3") wide self-sealing butt joint strips over end joints.
- C. Replace all insulation having loose joints or laps. Sloppy work will not be acceptable and such work shall be removed and re-applied.
- D. Provide ½" over the thickness of insulation specified at all insulated piping in outside walls.
- E. Where insulation with a vapor barrier terminates, it shall be sealed with "Ductmate Protack". Ends shall not be left raw.
- F. On water piping use sheet metal shields outside the insulation at hanger locations. In addition, provide:
 - 1. A molded vegetable cork or foam glass insert not less than twelve inches (12") long of same thickness and contour as insulation between support shield and piping and under the finish jacket.
 - 2. Heavy density insulation minimum six (6) pounds per cubic foot under entire length of metal shield.
- G. Where piping and fittings are installed out of doors, provide [two-layer glass cloth and four-layer weatherproof vapor barrier adhesive coating, in addition to jacket specified] vapor barrier jacket, cover with metal or vinalum jacket with seams located on bottom side of horizontal piping.

3.03 TECHNIQUE FOR APPLICATION TO PIPE FITTINGS, UNIONS AND VALVES

- A. On insulated piping with vapor barrier, insulate fittings, unions, valves and flanges including Victaulic and Gustin-Bacon to the same thickness as the pipe insulation.
- B. Any of the following methods of insulation is acceptable:
 - 1. PVC Snap Form Fitting Covers: Wrap all valves and fittings with precut fiberglass insulation wraparound inserts. Brush vapor barrier mastic on adjoining section of pipe insulation and on overlapping edges of jacket and throat seam before applying preformed fitting. Secure cover with stainless steel tacks. Tape joints with pressure sensitive vapor barrier tape.

3.04 TECHNIQUE FOR APPLICATION TO DUCTWORK

- A. Impaling Over Pins: Install all insulation with edges tightly butted. Impale insulation on pins welded to the duct and secure with speed clips. Trim off pins close to speed clip. Space pins as required to hold insulation firmly against duct surface, but not less than one pin per square foot. Seal all joints and speed clips with glass fabric set in adhesive. Provide metal angle at corners to protect edges of insulation.
- B. Other Method of Securement: If the welded pin method is impossible, secure the insulation to the duct with "Ductmate Protack" or Childers CP-127 or Foster 85-60 adhesive. Cover the entire surface of the metal with adhesive when applying to the underside of horizontal ducts. Application to top and sides may be in strips with a minimum of 50% coverage. Additionally, secure insulation with No. 16 galvanized wire on not more than twelve inch (12") centers.

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Provide metal angle at corners to protect edges of insulation. Seal joints as above. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

- C. Where external insulations terminate, seal insulation to ductwork with Childers CP-35 or Foster 30-65 with 3" glass fiber reinforcing mesh.
- D. Impale rigid insulation board over pins. Provide two layers of glass cloth and four layers of weatherproof vapor barrier adhesive coating. Install .040 thick lock-formable aluminum jacket over sealed insulation. All joints are to be 1" standing seams. The top of the aluminum jacket is to slope a minimum of 1" in 12" to sides to prevent collection of water. Install tapered insulation under sloped top for support of aluminum jacket. Provide a minimum of 1" flange out at connection point to mechanical equipment and building to ensure that water does not get under jacket. Provide counterflashing that is appropriate for building material type. Coordinate with Architect to ensure a watertight connection to building.

3.05 EXAMINATION (LINED DUCTWORK)

- A. Verify that the duct liner products is installed in accordance with project drawings, duct liner operating performance parameters and limitations, and provisions of NAIMA FGDLS or SMACNA HVAC DCS or manufactures recommendations.

3.06 INSTALLATION (LINED DUCTWORK)

- A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. All joints shall be neatly butted and there shall be no interruptions or gaps. Duct liner shall be installed with the Printed air stream surface treatment exposed to the air stream.
- B. Duct liner shall be adhered to the sheet metal with 90% (minimum) coverage of adhesive complying with the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. All transverse edges that are not to receive sheet metal nosing shall be coated. Longitudinal joints shall occur at the corners of ducts. If duct size and standard duct liner product dimensions make exposed longitudinal joints necessary, such joints shall be coated with adhesive designated for duct liner application and which meets the requirements of ASTM C 916. Such joints shall be additionally secured with mechanical fasteners in accordance with NAIMA FGDLS, or SMACNA HVAC DCS as if they were transverse joints.
- D. Duct liner shall be additionally secured with mechanical fasteners complying with the requirements NAIMA FGDLS or SMACNA HVAC DCS and of the correct type for the duct liner being installed. Fasteners may be either weld-secured or impact-driven, and shall be installed perpendicular to the duct surface. Mechanical fasteners shall not compress the insulation more than 1/8" (3 mm) based on nominal insulation thickness. Fastener spacing with respect to interior duct dimensions shall be in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fastener heads or washers shall have a minimum area of 0.75 in² (484 mm²), with beveled or cupped edges to prevent their cutting into the duct liner.
- E. Where air velocities exceed 4000 fpm (20.3 m/sec), metal nosing (either channel or "zee" profile) shall be installed on upstream edges of liner duct sections.
- F. Metal nosing shall be securely installed over transverse liner edges facing the airstream at fan discharge and at any point where lined duct is preceded by unlined duct.

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- G. Duct liner in roll form shall be folded and compressed in the corners of rectangular duct sections, or shall be cut and fit to assure a lapped, compressed corner joint
- H. Duct liner in sheet form shall be cut and fit to assure tight, over-lapped corner joints. Top pieces of liner shall be supported at the edges by the side pieces
- I. Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTM C916.

3.07 FIELD QUALITY CONTROL (LINED DUCTWORK)

- A. Upon completion of installation of lined duct and before HVAC system start-up, visually inspect the ductwork and verify that duct liner has been correctly installed. Confirm that the duct system is free from construction debris.
- B. After the lined duct system is completely installed and ready for service, conduct a final inspection of the entire system. This inspection should include, at minimum, the following steps:
 - 1. Check all registers, grilles, and diffusers to ensure that they are clean and free from construction debris.
 - 2. Check all filters in accordance with their manufacturer's instructions. Use specified grade of filters at all times that system is operating.
 - 3. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork.
 - 4. Turn the HVAC system on and allow it to run until steady state operation is reached.
 - 5. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.
 - 6. Check to ensure that air delivery performance meets all requirements and complies with SMACNA leakage specifications.

3.08 PROTECTION (LINED DUCTWORK)

- A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.
- B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.09 COLD PIPING INSULATION

- A. Insulate piping for domestic cold water, using one inch (1") Type "A" or Type "B" Insulation.

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- B. Provide a complete vapor barrier throughout the entire system. Use only vapor barrier adhesives and coatings. Stapling of jacket not permitted. Penetrations in vapor barrier jacket, joints, and seams sealed vapor proof with Childers CP-35 or Foster 30-65 (white) mastic. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. Cover ends of insulation sections with an adhesive coating at intervals of not more than twenty feet (20'). Insulate accessories, valves, flanges, etc.
- D. Cover insulation on fittings with spiral-wrapped glass mesh tape. Finish with a vapor barrier coating applied approximately 1/16" thick.
- E. Insulate all horizontal runs at primary and overflow roof drain rain leader piping from bottom of roof deck to include roof drain body, to one foot (1') past turn down fitting in vertical direction. Vertical rain leaders need not be insulated when concealed, routed inside wall cavity.
- F. Insulate all cold water piping above ceiling to point where piping turns down into chase. When piping turns down into exterior walls, piping in exterior walls must be insulated.

3.10 HOT & TEMPERED PIPING INSULATION

- A. Insulate domestic hot and tempered water and circulating lines using one inch (1") Type "A" insulation one inch (1") thickness for ½" to one inch (1") piping, 1-1/2" thickness for 1-1/4" to two inch (2") piping and two inch (2") thickness for 2-1/2" to six inch (6") piping. Domestic hot water lines may be insulated with one inch (1") Type "B" insulation.
- B. Staples may be used to seal jacket.
- C. Insulate unions, valves and flanges in boiler room only for piping over 140° F. Insulate with same method used for cold pipe fittings, except vapor barrier mastic is not required.
- D. Do not insulate valves, flanges, and unions for domestic hot water piping systems below 140° F., but bevel and seal ends of insulation at such locations.
- E. Insulate hot water expansion tank and air separators with one inch (1") sheet type "B" insulation.

3.11 SPECIAL PIPING INSULATION REQUIREMENTS

- A. Insulate buried domestic hot and cold water lines under building with one inch (1") Type "B" Insulation. Bond joints using an adhesive; apply surface treatment as recommended by insulation manufacturer, taping not permitted. Set in sand bed and cover with minimum five inches (5") sand. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- B. **Insulate all refrigerant piping for heat pump systems and suction lines only for all other systems with Type "B" Insulation:** ½" thickness for piping up to 1" and 3/4" thickness for piping larger than one inch (1"), apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 Adhesive BLV LOW VOC. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. No tape is allowed. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**
- C. Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).

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- D. Insulate p-trap of all floor drains above the first floor and deep seal traps that receive condensate. Insulate with 3/4" thick Type "B" Insulation.

3.12 DUCT INSULATION REQUIREMENTS

- A. Insulate Ducts as Follows:

- 1. Thickness and Type:

- a. Exhaust Air and Outside Air Exhaust Ducts: Externally wrap with Type "C" Insulation; insulate from roof deck/wall exterior back three feet (3') into space. (R-6)
- b. Supply Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- c. Return Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building envelope.
- d. Outside Air: Supply ducts externally wrapped with Type "C" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- e. Relief Air: Externally wrap with Type "C" insulation when run through unconditioned spaces, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- f. Air Devices: Externally wrap backs of all supply, return and exhaust air devices including square to round adapters and boots with Type "C" Insulation. Properly seal all edges. Use R-8 insulation for air devices with backs outside of building insulation envelope and R-6 insulation when backs of air devices are located inside building insulation envelope.
- g. Kitchen Supply: Type "C" or Type "D" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.
- h. Exterior Ductwork: R-8 Type "E" and/or duct liner insulation.
- i. Special circumstance as noted: R-6 or R-8 Type "G" duct liner insulation.

3.13 CONDENSATE PIPING INSULATION

- A. Condensate piping to be insulated with Type "B" Insulation 1/2" thick. Entire condensate system to be insulated when copper pipe is used.
 - 1. Apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 BLV LOW VOC Adhesive. No tape will be allowed. Auxiliary condensate not required to be insulated. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

END OF SECTION

**SECTION 22 01 00 - INSIDE UTILITY TRENCH EXCAVATION,
BACKFILL AND COMPACTION**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes general requirements, products, and methods of execution relating to excavation, backfill and compaction of inside trenches for mechanical work. Inside trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.
- B. Scope: Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawings. Excavate and backfill utility trenches. Place and compact bedding material. Compact backfill material.
- C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

- A. Local Codes and Ordinances
- B. Texas Safety Standards
- C. OSHA - Section 1926.650

1.03 SAFETY PRECAUTIONS AND PROGRAMS

- A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

PART 2 - BEDDING MATERIAL

2.01 BEDDING MATERIAL

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use clean sand. Maintain moisture content within a range that will allow specified compaction.

RESTROOM BUILDING

2.02 TRENCH BACKFILL

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material compatible with structural backfill is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size four inches (4").

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Place all excavated material suitable for backfill in an orderly manner, and in conformance with safety codes.
- B. Dispose of all material not suitable for backfilling.
- C. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris and rock, and compact to proper grade before installing piping.
- D. Follow manufacturer's recommendations for minimum trench width, material type and cover requirements.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on the drawings.
- B. Construct trench with adequate width to allow compaction equipment to be used at the sides of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DEWATERING

- A. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

- A. Do not backfill until underground mechanical system has been properly tested, inspected and approved.
- B. Coordinate with the work of others, and complete all trench work in a timely manner.

3.05 BEDDING

- A. Place bedding material under, around, and over the pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.

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- C. Cover pipe with bedding material to building subgrade or to a minimum 12" depth before adding other backfill.

3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to building subgrade, or as shown on the drawings.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact all backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Architect.
- C. Compact other areas to preclude future settlement, or at least 85% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface to grade.
- B. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.

3.09 SPECIAL PRECAUTIONS

- A. Avoid unauthorized and unnecessary excavations.
- B. Minimize number and size of excavations under footings or bearing walls.
- C. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible chance of damage, and keep such precautions in place to eliminate possible damage.
- D. Backfill under footings and bearing walls, using maximum compaction or concrete of proportions as specified for footings.
- E. Avoid damage to all existing underground services, foundations, cables, conduit lines or foundations. Repair any existing underground work accidentally damaged at no additional cost to the Owner.

3.10 UNDER EXISTING SLAB INSTALLATION

- A. When breaking out an existing floor slab, make a saw cut and remove concrete. When repouring concrete, compact the fill to the same specifications as the building fill. Re: Architectural/Structural. General Contractor to make necessary saw cuts and patching as required. **Coordinate penetrations of existing grade beams with structural engineer.**

END OF SECTION

**SECTION 22 02 00 - OUTSIDE UTILITY TRENCH EXCAVATION,
BACKFILL AND COMPACTION**

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Related Work Specified Elsewhere:
 - 1. Section 20 00 00 - General Provisions
 - 2. Section 20 01 00 - Basic Materials and Methods
 - 3. Division 2 - Site Work
- B. Description: This section described general requirements, products, and methods of execution relating to excavation, backfill, and compaction of utility trenches outside of buildings. The arbitrary line of demarcation between inside and outside of buildings occurs 5' outside the building perimeter.
- C. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.
- D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders and debris. Maximum aggregate size passing a 2" sieve opening. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material is not available from trench excavation, import it from sources approved by the Architect.

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- B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size 4 inches.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavate trenches to depth and grades as shown on drawings.
- B. Place all excavated material suitable for backfill in an orderly manner and in conformance with safety codes.
- C. Dispose of all material not suitable for backfilling.
- D. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If ground surface is below specified pipe grade, fill to required depth with granular materials free from debris and rock, and compact to proper grade before installing piping.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on the drawings.
- B. Construct trench with adequate width to allow compaction equipment to be used at the side of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DE-WATERING

- A. Perform whatever work is necessary to prevent flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

- A. Do not complete backfill until utility system has been properly tested, inspected, and approved.
- B. Coordinate with the work of others and complete all trench work in a timely manner.

3.05 BEDDING

- A. Place bedding material under, around, and over pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.
- C. Cover pipe with bedding material to a minimum 6" depth before adding other backfill.
- D. Cover water line with 18" bedding material before backfilling.

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3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to finished grade, or as shown on the drawing.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact backfill material to preclude future settlement or at least to 90% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface to grade.
- B. Restore all surface areas to original conditions, or improve as shown on the drawings. Replace all paving, base course, gravel surfacing, sub-base, topsoil or other existing finished surface as shown on drawings.
- C. Clean up and finish all construction areas to original condition or better.

END OF SECTION

SECTION 22 11 16 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.
- B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.
- C. **SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 CONNECTION TO UTILITY WATER SYSTEM

- A. Coordinate with site utilities to properly locate and interface with the water supply. Stub water 5'-0" outside the building and make connection to water supply. See Civil Drawing for site utility locations.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS ABOVE GROUND (INSIDE STRUCTURE)

- A. Type "K" or "L" hard drawn copper tubing, wrought solder type fittings, lead free (0.00% lead content) solder.

2.02 PIPING AND FITTINGS BELOW GROUND

- A. 2" and Smaller:
 - 1. Type "K" soft copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.
 - 2. Use heavy duty Water-Tite-Sleeve as manufactured by IPS Corporation for all piping underslab. Sleeves for 1" and under shall be 25 mil., blue for cold water and red for hot water. Sleeves for 1 1/4" to 2" shall be 6 mil., black in color.
- B. 2-1/2" and Larger:
 - 1. Type "K" hard drawn copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.
- C. No joint to be installed under building slab.

2.03 WATER METER

Reference Civil Drawings

PART 3 - EXECUTION

3.01 GENERAL METHODS

- A. Make all joints in accordance with manufacturer's recommendations. The tools used shall be the tools adapted to that specific purpose.
- B. At all fixtures, install and connect hot water on left and cold water on right, as viewed when facing the fixture.
- C. Where required for connections to fixtures, equipment items, etc., employ lengths of red brass pipe with threaded ends of copper to IPS adapters, brass couplings, etc., to the end that there shall be no ferrous pipe in any water piping system.
- D. Provide valves on each branch line at the point of connection into the supply and circulating mains serving all batteries of plumbing fixtures. Provide stop valves in each water supply for every plumbing fixture. Each hose bibb is to have an individual shut off valve, separate from valves that would shut down a battery of fixtures. Valves for piping two inches (2") and smaller shall be ball valves.
- E. Provide water hammer arrestors with accessible isolation valve equal to Wade Shok-stops, JR Smith Hydrotrol 5000 Series, or Zurn Shocktrols A-1700 Series on cold water and hot water supplies to plumbing fixtures. Provide access door for all concealed arrestors. Shok-stops shall not be installed in the pendant position. **O-ring type arrestors are not considered equivalent. Arrestors are to be installed in locations and sized per Manufacturer's installation instructions.**
- F. Install vacuum breakers on all plumbing lines where contamination of domestic water may occur and on boiler make-up lines and hose bibbs.
- G. Insulate all exposed water connections for handicapped lavatories and sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868).

3.02 TESTING

- A. Test all water piping hydrostatically at 150 psig or 150% of working pressure, whichever is greater, for a period of 24 hours. Observe piping during this period and repair all leaks. Test for lead, certify that lead residual in piping system does not exceed local code requirements.

3.03 STERILIZATION OF DOMESTIC WATER SYSTEMS

- A. Sterilize each unit of completed supply line and distribution system with chlorine solution before acceptance for domestic operation.
- B. Accomplish sterilization as described below or by the system prescribed by the American Water Works Association Standard C-601. Apply the amount of chlorine to provide a dosage of not less than 50 parts per million. Provide chlorine manufactured in conformance to the following standards:
 - 1. Liquid Chlorine: Federal Specification BB-C-120.
 - 2. Hypochlorite: Federal Specification O-C-114a, Type 11, Grade B or Federal Specification O-X-602.

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- C. Introduce the chlorinating material to the water lines and distribution system after piping system has been thoroughly flushed. After a contact period of not less than 24 hours, flush the system with clean water until the residual chlorine content is not greater than .2 parts per million.
- D. Open and close all valves in the lines being sterilized several times during above chlorination.
- E. The sterilization process shall be done by persons whose major business is water treatment and sterilization. The Plumbing Contractor shall pay all costs and charges associated to this test and certification.
- F. Certify in writing that sterilization has been completed in accordance with these requirements.

END OF SECTION

SECTION 22 11 17 –WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.
- B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.
- C. **SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 – PRODUCTS

2.01 WATER HEATER

- A. Electric Water Heater:
 - 1. Pre-wired, factory tested, NSF certified and with UL seal of approval.
 - 2. Tank: Glass lined and ASME approved for 150 psi working pressure with a minimum of 2" of high density foam insulation; Anode rods for electrolytic protection and hand hole inspection port.
 - 3. Thermostats are to be of the immersion type; one thermostat per each set of 3 elements.
 - 4. The complete system to be protected by energy cut off switch in the event of an over temperature situation.
 - 5. Manufacturer: State, PVI, A.O. Smith, Rheem or approved equal.
- 2.02 Provide an ASME rated temperature and pressure relief valve with drain piping to the nearest drain receptor for all water heaters. The temperature and pressure relief valve shall be labeled and shall be tested in accordance with ANSI Z21.22.
- 2.03 Provide heat traps on incoming and discharge lines from water heaters that do not come with factory installed heat traps or are not connected to a recirculation system.

END OF SECTION

SECTION 22 13 16 - LIQUID WASTE TRANSFER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products, and methods of execution relating to the transfer of liquid waste for the project. The work of this section includes providing the following:

a. All liquid waste piping and fittings:

- 1) Soil
- 2) Rain leaders
- 3) Building sewer

b. All plumbing vents, including their termination.

c. All connections at points of collection of handling:

- 1) At plumbing fixtures and trims
- 2) At equipment by others.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.

IF PVC OR CPVC IS USED IN PLENUM SPACES IN LIEU OF CAST IRON, THEN PIPING MUST BE WRAPPED WITH CODE APPROVED INSULATION TO PROTECT PIPING AND MEET 25/50 REQUIREMENTS.

D. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International as well as conform to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings, and be manufactured by Charlotte, Tyler, or AB&I .

E. All pipe and fittings shall be manufactured in the United States.

RESTROOM BUILDING

- 1.02 CONNECTION TO UTILITY SEWER AND STORM DRAIN SYSTEMS (storm drain piping is considered to be piping beyond 5'-0" outside the building)
- A. Final wastewater connection point to extend approximately five feet (5') outside the building, as indicated on the drawings. Coordinate with Civil Drawings for wastewater service point to within five feet (5') of the building. **Coordinate with site utilities to insure proper inverts for all lines and connection point prior to installation.** Contact Architect immediately if any conflict is discovered. Make final connection to service line. Obtain all permits, pay fees and provide all services incidental to this work.

PART 2 – PRODUCTS

- 2.01 SEWER PIPE UNDERGROUND INSIDE STRUCTURE (INCLUDES TO FIVE FEET FROM BUILDING PERIMETER)
- A. Service weight cast iron soil pipe with Tyseal neoprene gaskets.
- B. Schedule 40 PVC (SOLID WALL DWV pipe and fittings) as allowed by code. Material Data: Type 1, Grade 1 PVC 12454-B, ASTM D-1784.
- C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.
- D. Waste line serving commercial dishwasher in kitchen and associated main to be service weight cast iron soil pipe with Tyseal neoprene gaskets to a point twenty feet (20') downstream of dishwasher. Remainder of grease system in kitchen may be PVC as listed in 2 above.
- 2.02 RAINLEADERS BELOW SLAB AND ABOVE GROUND INSIDE STRUCTURE
- A. Cast iron soil pipe with heavy weight no-hub fittings.
- B. **Underground RAINLEADER piping: Use stainless steel couplings (28-gauge, Type 304SS) with neoprene gasket meeting ASTM Standard C-564 meeting FM 1680, Class 1. Husky SD 4000, Clamp-All 80 lb. or equal.**
- 2.03 SEWER ABOVE GROUND INSIDE STRUCTURE
- A. Service weight cast iron soil pipe with tyseal neoprene gaskets or cast iron soil pipe with no-hub fittings. Reference 2.06 below.
- B. Schedule 40 PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**
- C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.
- 2.04 VENTS
- A. All vent piping above slab to be cast iron soil pipe with tyseal neoprene gaskets or no-hub fittings.
- B. All vent piping under slab to be heavy weight no-hub fittings.
- C. Vents 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron fittings.
- D. DWV copper with wrought or cast solder fittings.

RESTROOM BUILDING

- E. Schedule 40 PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**

2.05 CAST IRON PIPE/FITTINGS

- A. Tyseal Gaskets or MG Couplings.
- B. Hubless couplings shall be composed of a stainless steel shield, clamp assembly and an elastomeric sealing sleeve conforming to the most current edition of CISPI 310, listed by NSF International, manufactured in the United States of America, and manufactured by Anaco, Mission, Tyler or Ideal.

2.06 CONDENSATE PIPING

- A. Type L or M: Hard drawn copper.

PART 3 – EXECUTION

3.01 INSTALLATION OF UNDERGROUND PIPING

- A. Install pipe and fittings to required grade with hubs and bottom half section in undisturbed soil. Follow manufacturer's installation requirements.

3.02 INSTALLATION OF ABOVE GROUND PIPING

- A. Refer to Section 20 01 00.

3.03 GRADING

- A. Grade all horizontal runs of pipe in building and under floor slab at 1/4" per foot downward in direction of flow. If it is absolutely impossible to maintain a grade of 1/4" per foot, piping four (4) inches in diameter and larger may slope to a minimum grade of not less than 1/8" per foot.

3.04 SUPPORTING

- A. Support all horizontal runs of pipe in building at intervals not to exceed 5'-0" and at each change of direction. Provide a support at the base of vertical risers with intermediate supports as required. Brace all adequately to prevent motion, per manufacturer's recommendation. Reference Section 20 01 00, 2.08, B., Mechanical Support Devices and Pipe Supports for further requirements.

3.05 CLEANOUTS

- A. Provide cleanouts as shown on plans and in an accessible location at base of all risers in soil, waste and drain piping and at each change in direction in horizontal runs of pipe. In long straight runs, provide a cleanout located at intervals of not more than 75 feet for piping four inches (4") and larger and located at intervals of not more than 50 feet for piping less than four inches (4").
- B. Cleanouts shall be located no closer than 24" to a wall.

RESTROOM BUILDING

3.06 VENTING

- A. Provide a vent for each trap or as shown on the drawings.
- B. Extend each vent vertically to a point not less than six inches (6") above the extreme overflow level of the fixture served before offsetting horizontally. Whenever two or more vent pipes converge, extend each such pipe at least six inches (6") in height above the flood rim level of the plumbing fixture it serves before being connected to any other vent and utilize only approved drainage fittings and materials to connect piping.
- C. Provide a building main relief vent for waste piping not provided venting by fixture branch connections. Vent size shall be per code requirement, based upon fixture unit loading in the pipe vented.

3.07 VENTS THROUGH ROOF

- A. Extend vents through the roof a minimum distance of 6" and terminate at least 15 ft. horizontally from operable windows, doors, or air intakes, and at least 3 feet above such opening. Do not terminate vents through roof at edge or valley of roof.
- B. Flash and counterflash vents through roof. Provide flashings not less than 18" square, with prefabricated 4-pound lead counterflashing. Extend vertical portion of flashing up entire length of pipe and turn down inside the pipe at least 1 inch with turned edge hammered against pipe. Coordinate with type roof and Architectural details and flash them into roof according to the roofing products manufacturer's recommendations.
- C. Protect the roof from tools and equipment. Remove all scraps on roof to prevent damage to roof.

3.08 GENERAL

- A. No piping shall be permanently concealed before the examination is completed by the authorities having jurisdiction.
- B. All fixtures used in conjunction with the conveying of waste substance shall be connected by means of a trap.
- C. All connections for floor mounted water closets and waste piping shall be made with appropriate closet flange and wax gaskets.
- D. Insulate all exposed p-traps for handicapped lavatories and handicap sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868) as required.
- E. Provide specialty shielded transition coupling as required at connections between PVC and cast iron fitting.

3.09 TESTING

- A. Test all piping in accordance with the requirements of the local codes.
- B. Repair leaks and retest system, repeating this process until piping system is free of leaks.
- C. Test shall be conducted and completed before any joints are concealed or made inaccessible.
- D. Maintain a log of tests indicating date, time, result of test and person doing test.

RESTROOM BUILDING

- E. Under floor.
 - 1. Test pipe under floors before connecting to sewers.
 - 2. Maintain not less than 15 feet of hydrostatic head.
 - 3. Repair all leaks and repeat until system holds for 2-hours without a drop in water level.

3.10 CONDENSATE PIPING

- A. Route insulated copper condensate drain line from each unit to nearest floor drain, deep seal traps, sink p-traps, janitor sink, dry well (exterior units), or roof drain if piped to storm sewer (cannot use roof drain if day lites at surface) code approved or disposal point unless otherwise noted. Condensate shall not drain on to roof. Mechanical Contractor and Plumbing Contractor to coordinate locations. Slope all piping to drain at minimum 1/8" per foot. Drains shall be sized in accordance with equipment capacities as follows:

EQUIPMENT CAPACITY	*MINIMUM PIPE SIZE
Up to 3 tons of refrigeration	3/4"
3 to 20 tons of refrigeration	1"

*Minimum size of drain shall not be smaller than drain outlet size for unit.

- B. Coordinate mounting heights of units to allow adequate slope for condensate piping to disposal point.
- C. Provide cleanout plug at end of each main run.
- D. Drywell (French Drain): The drywell shall consist of a pit not less than 24" in diameter (or 24" x 24") and 24" in depth. The pit shall be filled to within 3" of the finished grade with coarse gravel. Top 3 inches to be filled with topsoil and sodded. Gravel to be wrapped completely (top, sides and bottom) with heavy duty weed block fabric. Install a 3" perforated PVC drain pipe (centered in drywell) with cap at bottom extending to bottom of pit. 3" perforated pipe to extend 3" - 5" above finished grade. Provide appropriately sized bushing or fittings to rigidly tie to condensate drain line from unit. Perforated pipe above grade will act as air break connection. Twenty-four inch (24") diameter or 24" x 24" x 24" deep can be used for up to 5 ton capacity. Thirty-six inch (36") diameter or 36" x 36" x 24" deep can be used for up to 13 ton capacity. Forty-eight (48") inch diameter or 48" x 48" x 24" deep can be used for up to 30 ton capacity. Confirm final requirements with code authority having jurisdiction.

END OF SECTION

SECTION 22 30 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
 - 1. This section describes certain components of domestic plumbing systems, including related specific requirements, products and methods of execution. Plumbing water, waste, vent piping and other primary distribution components of the plumbing system are included with related work specified elsewhere.
- B. **SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

- A. All floor drains, including floor sinks, are to be the same size as the waste line size indicated on plans. If size is not indicated, drain size shall be 3". Floor drains that tie in to acid waste piping are to have acid resistant coating or be stainless steel. Floor Drains and Floor Sinks in kitchen areas are to have Acid Resistant Enamel coating or be constructed from stainless steel.
- B. **PROVIDE TRAP PRIMING APPARATUS FOR EACH FLOOR DRAIN AND FLOOR SINK UNLESS NOTED OTHERWISE.** Whenever possible, use an inverted tee connection from sink tailpiece or device similar to Jay R Smith Prime-EZE for trap priming with gray water. Second choice is to use flush valve trap primer connection. As last resort, provide mechanical trap primer (Manufacturer: Precision Plumbing Products, "Oregon #1 or equal as required) connected to supply lines as small as possible, but never over 1-1/2" diameter. Provide minimum 12 x 12 access door or larger as required. When local jurisdiction (such as the City of Pflugerville, Tx.) does not approve the use of a standard mechanical trap primer (similar to Oregon #1) that activates from pressure differential and other methods are not practical, provide an electronic trap primer as last resort. Coordinate electrical requirements with electrical contractor. Proset "TRAP GUARD" device may be used in lieu of trap primers when allowed by local code authority having jurisdiction and building Owner. Before using Proset "TRAP GUARD" contractor must obtain written approval from local code authority having jurisdiction and provide copies to Architect and Engineer.
- C. Trap primers must conform to ASSE 1018 or ASSE 1044.
- D. Trap Primer Manufacturers: MIFAB, Precision Plumbing Products, Jay R Smith, Sloan, Zurn, Wade or Watts.
- E. Floor Drain/Floor Sink Manufacturers: StainlessDrains, Kessel, MIFAB, Josam, Wade, Zurn or Jay.R. Smith, Watts.

RESTROOM BUILDING

2.02 CLEANOUTS

- A. Cleanouts shall be same nominal size of pipe lines up to four inches (4") and not less than four inches (4") for larger lines.
- B. Floor Cleanouts: Gas and watertight seal, internal taper ABS cleanout plug, stainless steel or nickel bronze finish scoriated round top with countersunk screw for installation flush with finish floor. MIFAB C1100R-3 Series. If floor has a waterproof membrane then add C clamp ring flange.
- C. Wall Cleanouts: MIFAB C1400-RD Series. Countersunk plugs, with smooth round access cover and polished stainless steel or nickel bronze finish.
- D. Manufacturers: StainlessDrains, MIFAB, Josam, Zurn, Wade, Watts or approved equal.
- E. Cleanouts that tie in to acid waste piping to be acid resistant.

2.03 FIXTURES

- A. Manufacturers:
 - 1. The fixtures are chosen from standard manufacturers.
 - 2. Provide all similar fixtures and trim from one (1) manufacturer, except where specified otherwise.
 - 3. Equality: The following manufacturers are considered equal, specified item(s) sets minimum standard for acceptability.
 - a. **Fixtures:** American Standard, Crane, Eljer, Kohler, Elkay, Fiat, Sloan, Toto, Zurn, Caroma.
 - 1) All water closet bowls shall have fully glazed trap.
 - 2) All water closet bowls must meet MAP Testing (Maxim Performance Testing) at 1000 grams.
 - b. **Faucets:** American Standard, Bradley, Elkay, Chicago, Sloan, Zurn, T & S Brass, Moen Commercial.
 - c. **Stainless Steel Sinks:** Elkay, Bradley, Moen or Just.
 - d. **Carriers:** MIFAB, J.R. Smith, Josam, Watts or Zurn.
 - e. **Flush Valves:** Sloan Royal or equal by Zurn
 - f. **Point of Use ASSE 1070 Lead Free Mixing Valves:** Watts, Powers, Bradley, Leonard, Lawler, Symmons or Moen.
 - g. **Drinking Fountains/Electric Water Coolers:** Elkay, Acorn Aqua Surf, Oasis or Halsey Taylor, must meet NSF Section 9 in its entirety and meet TCEQ Certification Requirements. Provide letter with submittal data.
 - h. **Wash Fountains:** Bradley, Wiloughby or Sloan Stone.

RESTROOM BUILDING

- i. **Wall Pipe Supports:** HoldRite or Equal
 - j. **Circulating Pumps:** TACO, Grundfos, Armstrong, Wilo
 - k. **Stainless Steel Skullery Sinks:** Elkay, Bradley, Just, Advance Tabco, Griffin.
 - l. Provide wall carriers for ALL wall-mounted fixtures, including wash fountains.
- B. Traps, Stops and Supplies:
 - 1. Provide traps, stops and supplies for all fixtures.
 - 2. P-Traps: 17 gauge chrome-plated cast brass.
 - 3. Supplies: Flexible, chrome-plated, 7538 Series.
 - 4. Stops: Removable key type, 2302 Series.
 - 5. Supplies and stops are to meet current requirements of NSF61.
 - 6. Manufacturers: American Standard, Brass Craft, McGuire or equal.
- C. Fixtures Specified Elsewhere, or Otherwise Furnished. Provide appropriate strainer, tailpiece, trap, waste and supplies. Rough-in and connect only.
- D. Faucets:
 - 1. All faucets except commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed by NSF as residential drinking water faucets.
 - 2. All faucets not NSF 61 listed, (as described in paragraph 1) must have tin lined waterways or other such material so water flowing through the faucet is not in contact with any material that could allow "Leaching" of lead into the waterway.
 - 3. Commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed as commercial faucets. Faucets meeting the stricter residential standards can be used at contractor's option.
 - 4. Faucets are not allowed to have more than the maximum total lead content as listed by NSF, TCEQ (Health and Safety Code) and EPA.
 - 5. Any faucets which exceed lead concentration "Leaching" into water stream after a minimum of 45 days usage and proper flushing prior to testing shall be replaced by the manufacturer with an acceptable product. All costs of change out incurred will be sole responsibility of the manufacturer.
 - 6. Lavatory faucets to have .5 GPM vandal resistant aerator.
- E. Waterways and tanks for all drinking fountains and water coolers shall be constructed of 3. lead-free (0.00% lead) materials. All waterways to be totally free of lead. No lead solder is permitted. All drinking fountains and water coolers to meet latest criteria of TCEQ, EPA and be listed by NSF.

RESTROOM BUILDING

- F. All water line, fittings and fixtures in contact with potable water to be "lead free" AB1953 compliant. (.25% or less average lead content). All submittals to state items comply in submittal package.

2.04 FIXTURE FLOW RATES

- A. The maximum flow rates for plumbing fixtures are to be no greater than quantities listed below:
 - 1. Toilets – 1.28 gallons per flush GPF) on all projects .
 - 2. Urinals – 0.125 gallons per flush (GPF) on all projects
 - 3. Lavatory (hand sink) – 0.5 gallons per minute (GPM) on all projects
 - 4. Shower – 2.0 gallons per minute (GPM) on all projects

PART 3 - EXECUTION

- 3.01 Store all fixtures and trim above ground in a covered location not subject to accidental damage by traffic or other construction activities. Handle fixtures and trim carefully to avoid chipping, denting, scratching, or other damage. Replace damaged items with same item in new condition.
- 3.02 Provide permanent metal and wire positioners, supports and fixture carriers to secure fixtures and piping rigidly in proper alignment without sway or side play.
- 3.03 Anchor all fixtures securely to withstand applied vertical load of not less than 250 pounds on the front of the fixture, without noticeable movement.
- 3.04 Install all fixtures plumb, level and flush to the finished Architectural surface, so that the maximum gap between the fixture and the surface does not exceed 3/16 inch. **Grout** under water closets to level fixtures. Caulk the edge of the joint between fixture and surface with silicone or butyl type waterproof caulking compound.
- 3.05 Adjust all functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.
- 3.06 Clean all fixtures and trim thoroughly to spotlessly clean condition. Obtain a written certification from the Architect that this has been accomplished.
- 3.07 Where floor drains or janitor sinks are located over any room, provide waterproof installation.
- 3.08 Ensure final location of cleanouts have access and ample clearance at cleanout for rodding of drainage system. Check locations before installation. Contact Architect for alternate location if maintenance clearance is a problem. Cleanouts to be moved at no additional cost to Owner for failure to coordinate locations.
- 3.09 Coordinate slope of floors to floor drains with Architect. Adjust height of floor drain for proper drainage.
- 3.10 Provide all adapters, flanges, gaskets, etc. as required for proper installation of fixtures. Coordinate fixture placement before core drilling of floor or sleeve installation.

RESTROOM BUILDING

- 3.11 Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).
- 3.12 **No offset flanges will be allowed for installation of water closets.**
- 3.13 Install all trap priming devices per manufacturer's installation instructions. Provide shut-off valves at each mechanical or electronic trap primer for service. Install minimum 12" x 12" access doors as required for service of trap priming devices.
- 3.14 Provide a floor sink with trap priming device in each sprinkler riser room.
- 3.15 Cleanout locations:**
- A. On each horizontal drain line 5 feet or greater in length.**
 - B. No more than 50 feet on center.**
 - C. At changes in direction of 90 degrees or more (line size).**
 - D. At the end of each continuous waste line.**
 - E. At the end of each battery of fixtures.**
 - F. At each sink and urinal.**
 - G. Additional areas required for service and by code.**

END OF SECTION

SECTION 23 08 02 - CONTRACTOR START-UP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. **This section describes specific requirements and methods of execution which relate to the Contractor start-up of the mechanical installation by the mechanical contractor and their subcontractor's, acting together as a team. The contractor, all their subs and vendors (as required) will spend sufficient time TOGETHER at the site to insure that all requirements are met.**
2. Contractor start-up is a performance verification and documentation process of ensuring that all mechanical systems are installed and are performing according to the design intent and operational needs of the project. The Contractor start-up process encompasses a coordinated effort for system documentation, equipment startup, control system calibration, testing and balancing, and performance testing and training.
3. Contractor start-up by the contractor during the construction phase is intended to achieve the following specific objectives;
 - a. Verify that applicable equipment, controls and systems are installed according to the plans and specifications, manufacturer's recommendations and to industry accepted minimum standards.
 - b. **Verify and document proper performance of equipment and systems as a whole and as controlled by the DDC system. Verify that total integration of the mechanical and DDC systems are complete and fully operational in all modes. This requires both the mechanical contractor and the control contractor to work together at the site at the same time as required. Testing equipment operation with jumper wires or in a stand alone mode and/or testing controls for continuity does not meet the requirements of this section.**
 - c. Verify that the Owner's operating personnel are adequately trained.
 - d. Verify balancing report is completed and outside ventilation air quantities are confirmed.
4. **RETAINAGE WILL NOT BE RELEASED UNTIL WORK OF THIS SECTION IS SUCCESSFULLY COMPLETED. IF THE CONTRACTOR CAN'T COMPLETE THIS WORK IN A TIMELY FASHION IT WILL BE ASSIGNED TO A THIRD PARTY FOR COMPLETION AND BILLED AGAINST THE CONTRACTORS' RETAINAGE.**

- B. SPECIAL NOTE:** All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and checkout and functional performance testing shall be provided by the contractor for the equipment being tested.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according the Contract Documents shall be included in the base bid price to the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5° F and a resolution of + or - 0.1° F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

- A. Pre-Contractor start-up Meeting: At the beginning of the project the contractor shall schedule, plan and conduct a pre-Contractor start-up meeting with the district, engineer and construction manager to discuss process and procedures to be used in contractor Contractor start-up process.
- B. Miscellaneous Meetings: Other meetings will be held throughout project at owner, engineer or contractor request during construction, to cover Contractor start-up progress coordination, deficiencies, and other Contractor start-up issues.

3.02 EQUIPMENT REQUIRING MANUFACTURER START-UP:

- A. Standard manufacturer start-up forms shall be submitted for review.
- B. HCE forms must be fully completed and included in the Contractor start-up report.
- C. All standard forms shall be signed and dated by technician doing start-up and shall be included in final Contractor start-up report.

3.03 TESTING CRITERIA:

- A. **Systems shall be tested in all modes of operation (ie. cooling/heating, dehumidification, occupied/unoccupied modes, etc.). Systems may be started up in a stand alone mode before control integration is complete, however all HVAC systems must be totally rechecked in all modes of operation through the manipulation of the DDC system once that part of the work is complete. Using jumper wires and testing for continuity does not meet the testing requirements.**
- B. **Tests are to be performed under conditions that simulate actual conditions where possible. Simulated test conditions are allowed in order to confirm system functions at required conditions. At completion of individual tests, all affected building equipment and setpoints shall be returned to their pre-test condition.**

- C. **Simply filling out the associated Contractor start-up Form does not totally satisfy all requirements of this section. Perform all testing as outlined in this section. Provide signed and dated documentation of all testing. Legible field notes that are signed and dated are acceptable.**

3.04 CONTROLS:

- A. A sequence shall be submitted that gives a clear concise narrative of the functional operation for each different system. This should be coordinated with control submittal.
- B. Confirm as a minimum, the following for each space sensor (temperature, humidity, CO₂):
1. Verify that sensor is labeled to match associated equipment number.
 2. Verify that foam isolation pad is installed behind sensor.
 3. Verify sensor location is appropriate and not in direct airflow from adjacent grille or sunlight.
 4. Verify that sensor element is not in contact with cover, base or set point adjustment.
 5. Test sensor with separate meter adjacent to (with-in 4 inches) sensor and verify building automation system (BAS) readout is with-in tolerance. Adjust offset as required for proper calibration. Recheck sensor. Insure measuring instrument is allowed to settle out at each sensor prior to confirming reading. Temperature tolerance is +/- 0.5°F, humidistat tolerance is +/- 3%.
 6. Replace any bad sensors, and document which sensor is replaced.
 7. Confirm that push button override is set for 120 minutes.
 8. Confirm that push button override is operational.
 9. Confirm that set point adjustment at thermostat is set for +/- 3°F.
 10. Confirm occupied heating, cooling and RH set points.
 11. Confirm occupancy schedules. (May turn over to Owner with floor level schedule set at 7am to 4pm with no imbedded schedules at equipment level at owner's request.)
 12. Confirm fan status (continuous or automatic mode).
 13. Confirm that zone sensors are properly located, labeled and that they actually control the equipment that serves that zone.
 14. **Physically confirm that the HVAC equipment performs all of the functions that the controls can command it to do, in all modes. Continuity check alone is NOT SUFFICIENT.**
 15. **CONFIRM THAT ANY INTEGRAL UNIT MOUNTED CONTROL SETTINGS HAVE BEEN PROPERLY SET UP TO MATCH THE JOB REQUIREMENTS AND TO PROPERLY INTEGRATE WITH THE DDC SYSTEM AS INSTALLED.**
- C. Document all test data for sensors, etc, on appropriate control system Contractor start-up Forms.

RESTROOM BUILDING

3.05 ROOF TOP UNITS / SPLIT SYSTEMS:

- A. Submit any required manufacturer's start-up test report.
- B. In addition to any start-up reports perform checkout and record the following for each piece of equipment.
 - 1. Unit size and model number.
 - 2. Outside air (O/A) temperature and humidity during testing period.
 - 3. Verify interior of unit is clean.
 - 4. Insure O/A damper has been adjusted and balanced, permanently mark position of damper.
 - 5. Verify that fan rotation is correct.
 - 6. Verify that cooling coil is clean.
 - 7. Verify that condenser coil is clean and fins are not damaged.
 - 8. Verify that hail guards are installed if specified.
 - 9. Confirm that condensate drain and trap are installed properly and drain pan is clean.
 - 10. Verify that overflow switch is installed and working properly for AHU's.
 - 11. Verify that heating and cooling modes are functioning and record inlet and discharge air temperatures in each mode.
 - 12. Verify that filters are clean.
 - 13. Confirm that belt tension and alignment has been adjusted properly.
- C. Document all Contractor start-up data on Form C2.0 for Roof Top Units and on Form C3.0 for Split System Units.

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS				
FORM C1.0		Page 1 of 2		
(CONTROLS CONTRACTOR)				
PROJECT NAME: _____		PAGE: ____ OF ____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
1	TEMP. SENSOR LABELED			
2	HUMIDITY SENSOR LABELED			
3	CO2 SENSOR LABELED			
4	FOAM ISOLATION PAD INSTALLED BEHIND SENSOR			
5	VERIFY TEMPERATURE / HUMIDITY / CO2 SENSOR LOCATION (LIST ROOM #)			
6	LIST OFFSETS INPUT TO CALIBRATE TEMPERATURE / HUMIDITY / CO2			
7	SENSOR PUSH BUTTON OVERRIDE SET FOR 120 MINUTES & FUNCTIONAL			
8	SET POINT ADJUSTMENT AT SENSOR +/- 3 DEGREES			
9	OCCUPIED COOLING SET POINT			
10	OCCUPIED HEATING SET POINT			
11	UNOCCUPIED COOLING SET POINT			
12	UNOCCUPIED HEATING SET POINT			
13	OCCUPANCY SCHEDULE			
14	HUMIDITY SET POINT (%RH)			
15	FAN STATUS ON SS/RTU A = AUTO C = CONTINUOUS			

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS				
(CONTROLS CONTRACTOR)		FORM C1.0		Page 2 of 2
PROJECT NAME: _____		PAGE: ____ OF ____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
16	PHYSICALLY CHECK & VERIFY THAT CONTROL SIGNAL(S) ACTUALLY INITIATES ALL MODES OF UNIT FUNCTION REQUIRED FOR THE TYPE HVAC EQUIPMENT BEING CONTROLLED.			
17	VERIFY THAT UNITS INTERNAL CONTROL SET POINTS (ECTO SETTINGS ON LENNOX RTU'S FOR EXAMPLE) HAVE BEEN SET TO MATCH THE REQUIREMENT FOR THE EXTERNAL CONTROLS ACTUALLY INSTALLED.			
18	LIST EQUIPMENT TYPE, IE, E/E SS, HP SS, GAS HEAT RTU, E.E RTU ETC...			
19	LIST COOLING STAGES			
20	LIST HEATING STAGES			
21	IF HEAT PUMP, DOES EM. HEAT COME ON DURING DEFROST CYCLE?			
22	IF HORIZONTAL SPLIT SYSTEM, IS FLOAT SWITCH WIRED INTO CONTROLS?			
23	VERIFY THAT OWNER HAS RECEIVED SPECIFIED AMOUNT OF OWNER TRAINING.			
24	VERIFY THAT SITE COMPUTER HAS BEEN INSTALLED WITH ALL REQUIRED PROGRAMMING, GRAPHICS & BACKUP CD OF SITE SPECIFIC PROGRAMMING.			
ok = ITEM VERIFIED AND ACCEPTABLE				
X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION				
n/a = DOES NOT APPLY				
REMARKS:		POINT TO POINT CHECK OUT OF CONTROLS DOES NOT CONSTITUTE THE FUNCTIONAL CHECK OUT REQUIRED.		

SPLIT SYSTEM CONTRACTOR START-UP				
FORM C3.0		PAGE 1 OF 2		
(MECHANICAL CONTRACTOR)				
PROJECT NAME: _____		PAGE: _____ OF _____		
FULL NAME OF INDIVIDUAL PERFORMING TEST: _____		DATE: _____		
#	DESCRIPTION	UNIT MARK		
1	UNIT SIZE / TYPE			
2	AHU MODEL NUMBER			
3	CU/HP MODEL NUMBER			
4	INDOOR TEMPERATURE (AND RH IF AVAILABLE)			
5	OUTSIDE TEMPERATURE / HUMIDITY			
6	CONDITION OF UNIT INTERIOR C = CLEAN NC = NEEDS CLEANING			
7	OUTSIDE AIR DAMPER ADJUSTED AND MARKED			
8	OUTSIDE AIR CONNECTED PER PLANS			
9	CHECK FAN ROTATION			
10	CONDITION OF INDOOR COIL C = CLEAN NC = NEEDS CLEANING			
11	CONDITION OF COND. COIL C = CLEAN NC = NEEDS CLEANING			
12	CU / HP SECURED TO ROOF SUPPORT			
13	DRAIN PAN CLEAN			

SPLIT SYSTEM CONTRACTOR START-UP				
FORM C3.O				PAGE 2 OF 2
PROJECT NAME: _____				PAGE: _____ OF _____
INDIVIDUAL PERFORMING TEST: _____				DATE: _____
#	DESCRIPTION	UNIT MARK		
14	CONDENSATE DRAIN AND TRAP INSTALLED PROPERLY			
15	COOLING DISCHARGE AIR TEMP. IF MULTISTAGE, ARE ALL STAGES OF COOLING OPERATIONAL?			
16	HEATING MODE DISCHARGE AIR TEMPERATURE			
17	IF HP, DOES EM HEAT COME ON IN DEFROST CYCLE?			
18	HOT GAS REHEAT DISCHARGE AIR TEMPERATURE			
19	CONDITON OF FILTERS C =CLEAN D = DIRTY			
20	BELT TENSION AND ALIGNMENT PROPERLY ADJUSTED			
21	ATTACH START-UP FORM WITH REFRIGERANT PRESSURES, AMPS, ETC.			
ok = ITEM VERIFIED AND ACCEPTAB				
X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION				
n/a = DOES NOT APPLY				
REMARKS:		ALL OPERATIONAL MODES ARE TO BE CHECKED BY MANIPULATING CONTROLS THAT THE OWNER WILL END UP WITH. USE OF JUMPER WIRES OR PLACING UNIT CONTROLLER IN STAND ALONE MODE IS NOT ACCEPTABLE FOR CONTRACTOR START-UP.		

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Description: This section describes specific requirements, products and methods of execution relating to the project air distribution systems.
- B. Provide all air distribution systems as shown and specified, complete in every detail and in perfect operating order.
- C. All equipment warranties to be per Specification Section 20 00 00, 1.17.
- D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 Provide all air distribution work in accordance with the minimum provisions of the latest approved editions of the following codes and standards.

- A. NFPA 90 A - Air Conditioning and Ventilating Systems.
- B. NFPA 90 B - Warm Air Heating and Air Conditioning.
- C. SMACNA - Low Velocity Duct Construction Standards.
- D. TIMA - Fibrous Glass Duct Construction Standards.
- E. SMACNA - Duct Liner Application Standard.
- F. SMACNA - Ducted Electric Heat Guide.
- G. AMCA Standard 210-74 Laboratory Methods of Testing Fans for Rating Purposes.
- H. AMCA Pub. 261 Directory or Products Licensed to Bear the AMCA Certified Rating Seal.
- I. AMCA Standard 300-67 Test Code for Sound Rating.
- J. AMCA Standard 301-65 Method of Publishing Sound Ratings for Air Moving Devices.
- K. AMCA Publication 511-75 Certified Ratings Program for Louvers, Dampers and Shutters.
- L. ASHRAE Standard 52-76 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- M. ASHRAE Standard 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

1.03 Where any references to "sheetmetal work" or "ductwork" appears in this section of these specifications or on the drawings, it shall be construed to include outside air ducts, supply air ducts, return air ducts, exhaust ducts, relief ducts, plenums, duct taps, grille taps, diffuser connections and all other related pieces and parts of the air conveying systems.

RESTROOM BUILDING

- 1.04 Before starting shop drawings or fabrication of any duct work, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, grille patterns, etc.

PART 2 - PRODUCTS

2.01 FANS

A. General Requirements for All Fans:

1. All fans constructed to AMCA Standards, AMCA listed and labeled.
2. Bearings:
 - a. At factory assembled package units 1HP and larger, provide 200,000 hour bearings (AFBMA L-50) selected at maximum fan rpm.
 - b. At packaged equipment 3/4HP and smaller, provide manufacturer's standard bearings.
 - c. Arrange equipment for easy access to lubrication fittings. Provide extended grease lines whenever easy access is not possible.
3. Balance fans statically and dynamically at factory.
4. Factory paint fan housing, fan wheel (except aluminum), frame and support brackets with prime coat and enamel finish coat at factory, after properly preparing surfaces.
5. Arrange fans to be cleanable and so that wheel, bearings, shaft, and drive are removable. Provide plug type cleanout doors or split fan housing. Gasket joints and bolt airtight.
6. Provide vibration isolation for all fans per manufacturer's recommendations.
7. Assemble fans at factory and test with permanent motor for proper operation, alignment and balance.
8. **All fans are to be of similar size and operational characteristics as fans scheduled. Smaller fans run at higher speeds will not be accepted.**

B. Belt Drives (All Belt Driven Fans):

1. Provide V-belt drive with sufficient belts to prevent slipping at start-up. Select drive for 1.5 service factor.
2. On each fan 10HP and smaller, provide variable pitch drive sheave with infinitely adjustable pitch diameter. Select drive sheave and fan pulley combination to provide fan rpm with drive adjusted to near mid-span.
3. Provide belt guard with hinged tachometer cap.

C. Roof Mounted Exhaust Fans:

1. Direct drive or have adjustable pitch v-belt AS SCHEDULED.

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2. Wheels shall be backward curved and housing shall be removable or hinged aluminum.
3. Isolate motor with vibration dampeners.
4. **Provide with motorized backdraft dampers unless gravity backdraft dampers are specifically listed on schedule. Damper actuator voltage to match fan voltage. Electrical Contractor to tie damper in to fan power.**
5. **Insulated, pre-fabricated metal roof curb shall be for flat or sloped roof as required for fan to be set level on roof.**
6. **Provide with galvanized bee screen.**
7. Maximum motor rpm is not to exceed scheduled rpm by more than 50 rpm.
8. Provide with 12" high roof curb to match roof slope. Curb to minimum of 12" above finished roof.
9. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

D. Ceiling Exhaust Fans:

1. Centrifugal wheel with inlet perpendicular to, or remote from, inlet grille. Acoustically insulated housing.
2. 85% free open area grille.
3. Electrical junction box on fan housing with cord, plug, and receptacle inside housing.
4. Fan, motor and wheel assembly removable through grille without disturbing housing.
5. **Motor mounted on rubber-in-sheer isolators, grounded, maximum rpm shall not exceed scheduled rpm by more than 50 rpm.**
6. Unit supplied with grille when indicated by model number scheduled.
7. Provide and install roof cap or wall cap as shown.
8. Unit UL labeled.
9. Integral backdraft damper, shatterproof, with no metal to metal contact.
10. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

2.02 FAN ACCESSORIES

A. Flexible Fan Connectors:

1. Provide at inlet and discharge of each fan, ERV, MAU, air handling unit, etc.
 - a. For Standard Application:
 - 1) Material suitable to withstand the pressure encountered. Constructed from coated heavy glass fabric, flameproof and ozone resistant. Joints to be sealed airtight. Minimum of 3" flex connection to be used.

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- 2) Manufacturer: Duro-dyne Corporation "EXCELON" or equal.
- b. For Outdoor Installations and Where Duct is Exposed to Toxic Fumes:
 - 1) Material suitable to withstand the pressure encountered. Constructed from heavy glass fabric, double coated with "Neoprene", non-combustible and fire retardant. Fabric to be waterproof and airtight. Minimum of 4" flex connection to be used.
 - 2) Manufacturer: Duro-dyne Corporation Duralon or equal.
2. Insulate over flex connection at inlet and discharge of all air handling units and rooftop units with minimum two inch (2") Type "C" insulation with minimum installed "R" value of 6.0. Seal termination of external insulation to ductwork with Childers CP-11 mastic with 3" glass fiber reinforcing mesh. Do not seal over any access panels.

2.03 DUCTWORK

A. Low Velocity Ductwork Systems:

1. Definition: Ductwork systems where duct pressures do not exceed 2" W.G. maximum static pressure and duct velocity does not exceed 2000 FPM. **Minimum duct gauge to be 26 gauge.**
2. All ductwork connected to louvers is to be sloped back to louver to insure that any water entering the duct drains back to the exterior of the building.
3. Ductwork Construction:
 - a. Ductwork, unless otherwise specified herein, shall be constructed of new, prime grade, continuous hot dip mill galvanized, lock forming quality steel sheets and shall have a galvanized coating of 1-1/4 ounces total for both sides per square foot. The gauges of metal to be used and the methods of duct construction shall conform to the requirements for the class of work involved as set forth in the latest edition of "Standard Practice in Mechanical Sheet Metal" as published by SMACNA. Each sheet shall be stenciled with the gauge and manufacturer's name. If coil steel is used, coils shall be stenciled throughout on ten foot (10') centers with the gauge and manufacturer's name. Insulate per Specification Section 20 07 00.
 - b. All dimensions are inside clear dimensions. Sheet metal size shall be increased to allow for duct liner where applicable.
 - c. Seal all transverse joints, seams and fitting connections with "Ductmate Proseal", Childers CP-146 or Foster 32-19, UL listed Mastic to prevent air leakage. Oil base caulking and glazing compounds are not acceptable. Duct sealant must meet VOC units per South Coast Air Quality Management District (SCAQMD) Rule #1168.
4. Rectangular Ducts:
 - a. Where special rigidity or stiffness is required, construct ducts of metal two gauge numbers heavier.

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- b. Ducts larger than 96" require special field study for gauging and supporting and supporting methods. (Furnish shop drawings for supporting and construction requirements.)
 - c. Rectangular low pressure ducts shall be constructed, braced and reinforced in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- 5. Round Ducts:
 - a. Construct round ducts from steel sheets, U.S. Gauge thickness, per SMACNA standards.
 - b. All exposed round ducts shall be double wall spiral duct per SMACNA standards with segmented fittings regardless of size.
 - c. Supply, return and exhaust duct runouts to/from air device shall be gauges as follows:
 - 1) up to 12" diameter 30 gauge,
 - 2) 14" to 18" diameter 28 gauge, and
 - 3) 20" to 22" diameter 26 gauge.

Provide minimum 26 gauge, 1" wide strap on heel and throat of adjustable fitting to provide additional rigidity.
- 6. Transitions:
 - a. Provide tapered transitions at changes in duct size and at connections to fans and other equipment.
 - b. Offset not more than 20°, on diverging flow and 30° on contracting flow, unless called for otherwise on drawing.
- 7. Elbows and Turning Vanes:
 - a. Use long radius, 45° and 90° fittings for all elbows and at tees, unless otherwise shown or space restrictions dictate use of square elbows.
 - 1) Construct fittings with centerline radius equal to 1-1/2 times the duct width at the turn.
 - 2) Where square vaned elbows are used, provide access doors as detailed below.
 - b. Turning Vanes: In all 90° turns in supply air ducts where 1-1/2 radius elbows cannot be used, install double radius turning vanes in square elbows.
 - 1) Ducts 19" and Smaller: Use small double vanes with an inner radius of two inches (2") and an outer radius of one inch (1") mounted on 3/4" center.

- 2) Duct 19" and Larger: Use large double vanes with an inner radius of four inches (4") and an outer radius of two inches (2"), mounted on three (3) 1/4" centers. Provide sound reduction type turning vanes: "Airsan" Acoustiturn, by Air Filter Corporation, "Sone-Turn" by Sound Control Products Company, per SMACNA Plat 22, or equal.
- 3) **Provide 12" x 12" insulated access door into duct on both sides of each vaned fitting to facilitate duct cleaning.**

8. Flexible Duct:

- a. Do not use flexible duct except where specifically called for on the plans.
- b. At diffuser connections:
 - 1) Provide duct listed as UL-181 Class I air duct, and constructed in compliance with NFPA 90A.
 - 2) **Minimum length 4 feet, maximum length 5 feet for supply ducts. Minimum length 4 feet, maximum length 5 feet for return air ducts. Install with not more than one (1) 90 full radius degree bend. Minimum and maximum lengths are to be closely followed since the flex duct acts as the main source of sound attenuation in the air system. Install with some slack in runout.**
 - 3) Make joints with Nashua brand UL181A-P Duct Tape (Venture #1599B or Shurtape #PC857) and two (2) 1/2" wide positive locking straps, one on inner core and one on outer jacket. Use Panduit straps.
 - 4) Minimum sound net insertion loss for duct as follows:

BAND, HZ	125	250	500	1000	2000
Loss dB/ft.	2.1	3.0	2.7	3.0	2.7
 - 5) Submit sound and construction data for proposed alternates.
 - 6) Tough vapor barrier reinforced metalized polyester jacket, tear and puncture resistant.
 - 7) Airtight inner core with no fiberglass erosion into airstream.
 - 8) **R-Value: 6.0 @ 75°F. mean temperature if within building insulation envelope, or R-value of 8.0 if outside building insulation envelope.**
- c. Do not use flex duct on exhaust systems.
- d. Manufacturers: **Atco 36 Series**, Certainteed, Thermoflex, Wiremold, Genflex, approved equal.

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- B. Entire interior of ducts shall be thoroughly cleaned of all oil residue and dust prior to installing.

2.04 DUCT ACCESSORIES

A. Air Volume Controls:

1. Provide air volume dampers, or other control devices, at each low pressure duct main and branch for a balancer to adjust the system to produce the air quantities shown.
 - a. Provide opposed blade damper for balancing in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.
2. Volume Dampers:
 - a. Flat sheet, single leaf damper with a continuous rod; damper leaf two (2) gauges (minimum 16 gauge) heavier than the duct where installed. Provide locking quadrants with indicators located accessible without demolition.
 - 1) Use for supply, return and exhaust ductwork 14" round or 14" x 14".
 - b. The locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with **stand-off mounting brackets, bases or adapters to provide clearance, between the duct surface and the operator, not less than the thickness of the insulation.** Stand-off mounting items shall be integral with the operator or a standard accessory of the damper manufacturer. All volume dampers indicated shall be provided with stand-off mounting brackets as required.
 - c. **All operators accessible and lockable. Do not insulate over top of volume damper operator handle.**
 - d. Locate dampers a minimum of 4 feet from diffusers.
3. Extractors:
 - a. Combination air straightening vanes and volume control with locking quadrant on outside or accessible through face of register.
 - b. Manufacturer: Titus AG-45 or approved equal.
 - c. Provide extractors at supply grilles attached directly to any main or branch duct serving more than one (1) grille.
4. Splitter Dampers:
 - a. Construct damper using sheetmetal blade hinge mounted inside duct.
 - b. Dampers or splitters shall be constructed from the same gauge metal as the ducts which they serve with a minimum of 22 gauge. Splitter length shall be 1-1/2 times the duct width up to 24" in size and above 24" in size shall be 1-1/4 times the duct width.
 - c. Attach Duro-dyne SRP-40 series splitter damper bracket to blade.

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- d. Connect 1/4" steel rod to damper bracket and extend through Duro-dyne SRP-14 ball joint damper casting mounting on outside of duct. Use 3/8" steel rod for splitter in ducts above 24" in size.
 - e. Install assembly for full swing of damper blade. Lock damper in proper position.
 - 5. Opposed Blade Dampers:
 - a. Provide opposed blade balancing dampers with multiple blades equal to Greenheck VCD-15, 20 gauge frame and 16 gauge blade construction with synthetic axle bearings and 1/2" diameter operator, complete with 1" stand-off and manual locking quadrant as follows:
 - 1) Use for outside air ductwork. Minimum damper size is actual duct size or 10" x 10" whichever is larger. Provide transitions as required.
 - 2) Use for supply, return and exhaust ductwork - 14" round or 14" x 14" and larger.
 - b. Damper material is to match ductwork material. (i.e., galvanized aluminum, stainless steel, etc.)
- B. Gravity Backdraft Dampers:
 - 1. Provide backdraft dampers counter balanced to desired static pressure setting. Wide open static pressure drop not to exceed 0.15" W.G.
 - 2. Damper blades aluminum with felt applied to tops of blades. Where dampers are exposed to outside temperature, provide neoprene edged blades.
 - 3. Damper frames extruded aluminum; nylon bearings.
 - 4. Assembly designed for operation at 20°F.
- C. Access Panels and Doors:
 - 1. Low Velocity System Access Panels:
 - a. Sheetmetal doors reinforced, cross-bracketed or otherwise stiffened to prevent rattle or vibration.
 - b. Seal doors airtight with felt edged gaskets.
 - c. Secure with hinges and sash locks.
 - d. Panels and doors for insulated duct systems are to be insulated.

2.05 GRILLES, REGISTERS AND DIFFUSERS

- A. Provide grilles, registers, and diffusers of the types and sizes called for on plans and in schedule on drawings.

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- B. Finish with factory applied finish for extruded aluminum items, and with a prime coat for steel items. (Provide an additional factory baked enamel finish to match ceiling grid.) (Submit color sample for approval.)
- C. Equip diffusers with panels of the proper size to match the suspended ceiling layout or with the proper frame for surface mounting. Fully correlate diffuser and grille style, dimension and fit with ceiling.
- D. Manufacturers: Price, MetalAire, Titus, Tuttle & Bailey, Krueger, Anemostat, Carnes
- E. All air devices located in damp areas are to be constructed from all aluminum components.
- F. Provide minimum 12" deep externally insulated boot for sidewall type supply air devices.
- G. Provide square to round transitions as required.
- H. Provide minimum 12" deep (top duct tap) or 24" deep (side duct tap) externally insulated boot for return air and transfer air devices.
- I. Provide minimum 12" deep boot for all exhaust devices.

2.06 LOUVERS AND HOODS

- A. Provide air exhausts through building skin, as shown.
- B. Louvers:
 - 1. Size as shown; air pressure drop not to exceed 0.15" W.G. when handling 1150 FPM per square foot of free area.
 - 2. Water penetration not to exceed .02 oz. per sq. ft. when handling 1150 FPM per square foot of free area.
 - 3. 4" deep drainable louver constructed of .125" thick 6063-T52 extruded aluminum alloy with channel frame.
 - 4. **Provide with 1/8" X 1/8" galvanized hardware cloth bee screen.**
 - 5. Finish to be factory primed for field painting or applied .7 mil thick anodized dark bronze as directed by Architect.
 - 6. Manufacturers: Greenheck ESD-403, Arrow, Carnes, Greenheck, Ruskin, Empco, Pottorff, or approved equal.
 - 7. Any plenum or ductwork attached to louver is to slope to drain back through louver to exterior of building.
- C. Hoods:
 - 1. Construction of heavy duty aluminum sheets with rolled interlocking seams with galvanized hood support members, similar to Greenheck Fabrahood or equal.
 - 2. Provide with bee screen on outside air intake hoods and 1/4" x 1/4" galvanized bird screen on relief hoods.

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3. **Curbs are to be a minimum of fourteen inches (14") high above finished roof surface and match slope of roof.**
4. Manufacturers: Greenheck, Acme, Penn, Cook, Briedert and Carnes.
5. Provide 120 volt motorized damper.

2.07 AIR FILTERS

A. General:

1. All air filters to be listed as Class 2 by Underwriters Laboratory, Inc., Building Materials Directory.
2. All arrestance, efficiency (dust spot efficiency on atmospheric air) and dust holding capacities specified are to be in accordance with ASHRAE Standard 52-76.
3. Performance characteristics are to be verified by certified data published in manufacturer's literature or by copies of current test data from an independent authorized test laboratory. Test data, where required, shall be an integral component of the manufacturer's submittal data.
4. Provide and install one (1) clean set of filters in all air moving units that require filtration at completion of project.

B. Disposable Panel Filters (for return air filter grilles and/or unit filter racks):

1. Media: Non-woven, lofted cotton bonded to 96% free area welded wire support grid. Not less than 2.45 square feet media area per square foot of filter face area. Arranged in radially pleated configuration and bonded continuously to inside perimeter of high wet-strength beverage board cell sides.
2. Cell Design: Two inches (2") deep with beverage board diagonal supports at entering air and leaving air faces of each cell.
3. Air Cleaning Performance: Minimum 25-30% efficiency 90-92% arrestance, MERV-7.
4. Initial Resistance: 0.2" W.G. at 500 fpm face velocity.
5. Dust Holding Capacity: Not less than 200 grams when operated at 500 fpm face velocity to a final resistance of .9 W.G.
6. Manufacturers: Cam-Farr Company Aeropleat II; AAF or approved equal.

C. Temporary Filters:

1. Reference 20 00 00, 3.07 for temporary filter requirements.

2.08 UNIT HEATERS (ELECTRIC)

- A. Provide UL listed electric unit heaters with voltage, phase, number of steps, heating and air delivery capacities, as scheduled. Suitable for vertical and horizontal mounting.
- B. Casings fabricated of die-formed heavy gauge steel and finished in high gloss baked enamel.

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- C. Steel finned tubular element. Provide automatic reset thermal cutout for each element.
- D. Individually adjustable discharge louvers.
- E. Thermostat to match number of heater control steps. Wall mount or built-in as scheduled.
- F. Provide angle support between unit heater threaded rod supports and nearest wall to prevent unit sidesway.
- G. Manufacturers: Markel, Brasch, Modine, Trane, Berko or approved equal.

2.09 FIRE DAMPERS

- A. Provide and install all fire dampers in all ductwork which passes a fire wall or fire rated ceiling as required by local building and fire safety codes.
- B. All dampers folding blade type with no part of blade in the air stream.
- C. All fire dampers UL approved and of type required by NFPA 90A.
- D. Install all fire dampers per manufacturer's instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit.**
- E. Provide UL rated sleeves and manufacturer supplied wall angles with damper.
- F. Provide four additional fire dampers to be sized and installed as directed by Architect.
- G. Manufacturers: Ruskin, Air Balance, Arrow, Greenheck, Nailor or approved equal.

PART 3 - EXECUTION

3.01 LOW VELOCITY DUCTWORK

- A. Provide ductwork in accordance with SMACNA low velocity standards.
- B. Provide backdraft dampers for all exhaust fans if motor operated dampers are not called for. Provide one inch (1") mesh bird screen at all exhaust discharges.
- C. Seal all transverse joints, seams and fitting connections with KINGCO 11-376 "Super Seal" or "Ductmate Proseal", U.L. listed.
- D. Where ducts, exposed to view, pass through walls, floors or ceilings, furnish and install sheetmetal collars to cover the voids around the duct.
- E. This work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling or vibration and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner.
- F. Duct shall be erected in the general locations shown on the drawings, but must conform to all structural and final conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site, and shall make all necessary changes in cross sections, transitions, offsets, etc., whether they are specifically indicated or not at no additional charge to the Owner.

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- G. Reinforce all ducts to prevent buckling, breathing, vibration or unnecessary noise, such reinforcing to be as recommended in the SMACNA manual plus any additional reinforcing as may be required to meet job conditions.
- H. Provide manually operated volume control dampers (with stand-off mounting brackets for externally insulated ductwork) in all branches, splits and taps for proper balancing of air distribution, whether shown on drawings or not, dampers to be either single blade or multi blade as shown in the SMACNA manual as required. They shall incorporate an indication device with lock to hold damper in position for proper setting.
- I. Damper operators in all unfinished areas shall be Young Series 400 of the exact style, type and size required. All other operators shall be Young #315 and/or #896 opposite end from the operator. Where dampers are installed in ducts located above accessible type ceilings, damper operators shall not be extended through the finished ceiling.
- J. All square elbows shall have turning vanes per the SMACNA manual requirements.
- K. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using "Ventglas" fabric that is fire-resistant, waterproof, mildew-resistant and practically air tight, and shall weigh approximately thirty ounces per square yard. There shall be a minimum of two and one-half inches (2-1/2") distance between the edges of the ducts. There shall be a minimum of one inch (1") of slack for each full inch of static pressure on the fan system.
- L. Furnish and install screens on all ducts, fans, etc. furnished by the Contractor which lead to, or are outdoors. Screens shall be 16 gauge, three-eighths inch (3/8") mesh in removable galvanized steel frames.
- M. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punches (not pin punches), and shall not be larger than necessary. All duct openings shall be provided with sheetmetal caps if the openings are to be left unconnected for any length of time. All panels of ducts twelve inches (12") and larger shall be cross broken.
- N. Furnish and install a minimum 16 x 16 x 2 internally insulated (foil facing to airstream) filter rack with a hinged type access door with cam or spring lock and filter in all unfiltered raw outside air ducts that connect directly to return air plenums.
- O. **All ductwork that is connected to any exterior louver or wall cap, etc. shall be sloped to drain outside.**

3.02 DUCTWORK SUPPORTS

- A. Support all ductwork to prevent sag, undue play, and swing. All horizontal ducts shall have a support within 2' of each elbow and within 4' of each branch intersection. Provide a hanger within twelve inches (12") from unit supply and return. Return air plenums on back of air handling units must have a minimum of four (4) support straps.
- B. Low Pressure Ductwork:
 - 1. Duct 40" and Less: Provide with 1" x 18 gauge straps fastened to ductwork, and to building construction. Space not more than eight feet (8') on center. Hanger straps shall lap under duct a minimum of one inch (1") and have a minimum of one (1) fastening screw on the bottom and two (2) on the side.

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- C. Vertical ducts supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles.
- D. Recommend methods of fastening bracing to ductwork, including riveting, bolting and tack welding.
- E. All flex duct runouts must be properly supported. Use minimum twelve (12) gauge wire with 8" long saddle that fits up to mid point of duct for support of flex duct. **Web Type fabric duct support is strictly prohibited.** Maximum permissible sag is 1/2" per foot of spacing between supports.
- F. Provide 1" x 20 gauge straps, minimum 8' - 0" o.c. for all round sheetmetal runouts that are 18" in diameter or less (except Spiral Ducts).

3.03 ACCESS

- A. Furnish all fans with consideration of location of motor and drive.
- B. Furnish and install in the ductwork, hinged access doors to provide access to all manual and automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. In rectangular ducts larger than twenty inches (20") in their smallest dimension, install access doors every twenty feet (20'). Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"). Factory fabricated doors as manufactured by Milcor meeting these specifications will be acceptable. Access doors shall be submitted for approval.
- C. Each fire damper door shall have a label with letters not less than 1/2" in height reading "**Fire Damper**", "**Corridor Ceiling Fire Smoke Damper**" or "**Fire/Smoke Damper**" (as applicable).
- D. Cycle damper after installation to insure free movement. Seal opening around fire damper with non-combustible material to maintain integrity of one (1) hour fire wall.
- E. Provide access door in supply air and return air drops from rooftop units, Access door to be in accessible location directly above first elbow. Access doors to be 18" X 18" minimum where duct size allows. Access doors shall be shown on ductwork shop drawings.
- F. Provide access doors for maintenance inspection and cleaning in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

3.04 Fully coordinate and work directly with the Balancing and Testing Agency to provide all systems in perfect operating order. Make corrections and adjustments as required by the Balancing and Testing Agency in a timely manner.

3.05 For Each Dryer: Provide 4" diameter or 5" x 3" rectangular flue pipe up through the wall and ceiling cavity and terminate into Briedert Cap. Provide transitions as required. Provide 4" diameter tie in point for residential type dryer or stacked washer dryer as required.

3.06 **CAP OPEN ENDS OF ALL DUCTS (INCLUDING SPIN-INS) AND EQUIPMENT WITH MINIMUM FOUR (4) MIL. PLASTIC TO PREVENT CONSTRUCTION DEBRIS AND DUST FROM ENTERING OPENINGS AT ALL TIMES DURING CONSTRUCTION.**

END OF SECTION

DIVISION 26

RESTROOM BUILDING FOR

CITY OF DEER PARK SOCCER COMPLEX

ELECTRICAL SPECIFICATIONS

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B.J. Hendrix

03/08/2017

F-4095

SECTION 26 05 00 - GENERAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

Unless otherwise specified, provide all labor, equipment, supplies, materials, superintendence and testing necessary for the installation of complete electrical systems as required by these specifications and as shown on the Drawings, subject to the terms and conditions of the contract. Complete such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the Drawings. Include empty conduits as required for all special systems and power for condensate pumps and HVAC control panels as required by the Mechanical Contractor. Field coordinate exact locations.

- A. Submit a bid on the basis of a complete installation, including all labor, material, cartage, insurance, permits, associated fees and taxes.
- B. Include temporary electrical power and lighting that will be required for the interior of the buildings. Provide lighting to satisfy OSHA requirements and the NEC.
- C. All Agreement Forms, General Conditions, Supplementary Conditions, and Division 1 of the specifications shall apply to the work specified in Division 26-28.
- D. Additional Site Visit Costs: The Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.
- E. No attempt has been made to show complete design details of building construction on the Electrical plans. Refer to Architectural, Structural and Mechanical plans for additional details which will affect electrical work. No extra cost will be allowed for offsets in conduit and wiring to avoid other work or when minor changes are necessary to facilitate installation or maintenance.
- F. Electrical Contractor is to provide all parts and labor to make final connections to all equipment shown in contract documents. Power may be shown in general location, it is expected that Electrical Contractor coordinate final locations for rough-in and connection requirements with exact equipment being installed. These items include but not limited to book security, exhaust fans, kilns, hand dryers, sensor operating plumbing devices, overhead doors, powered curtain, fire alarm door hold opens, etc.
- G. **NO TOXIC NOR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED.**
- H. AN EXTRA COPY OF ALL FIELD REPORTS SHALL BE KEPT IN A SEPARATE NOTEBOOK. CONTRACTOR TO SET UP IN THE CONSTRUCTION MANAGER'S TRAILER. THESE REPORTS SHALL BE USED FOR CONTRACTOR TO CHECK THAT EACH INDIVIDUAL ITEM NOTED HAS BEEN COMPLETED. ALSO KEEP LOG OF WHERE EXTRA RECEPTACLES AND OUTLET BOXES CALLED OUT IN 26 27 26, 3.01 AND 26 05 80, 2.01. ARE INSTALLED.
- I. **Electrical Contractor shall use Fire Alarm Contractor's Shop Drawings and Rough-In details on drawings for rough-in of all fire alarm devices. Any devices not roughed-in according to Fire Alarm Shop Drawings and drawing details shall be relocated at no cost to Owner.**

- J. Sensor Operated Plumbing Devices: Plumbing Contractor to provide transformers from manufacture. Electrical Contractor to provide all other electrical materials and labor to provide complete and workable device. This includes but is not limited to receptacles for plug in transformers, line voltage wire/conduit for direct connect low voltage transformers, all low voltage plenum rated 16 gauge wire.
- K. **Cad Drawings:**
Architectural Background Files – Architectural Files are background files, MEP drawings are not background files. To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.
- MEP Drawings** – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of \$500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.
- MEP CAD Files that will be released.**
- If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
 - Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
 - Fire Alarm/Fire Sprinkler/Intercom etc... Contractors must use Architectural Revit Models and CAD files for backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. This must be obtained from Architect. Engineer may not release architectural drawings.
- L. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner hereto in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.
- M. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures and for coordinating all portions of the Work under his Contract.
- N. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.
- O. Provide a completed Schedule of Values, see Specification Section 26 05 10. Preliminary schedule of values shall be submitted to Architect/Engineer for review.

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1.02 SITE INSPECTION

- A. Prior to Bidding, the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.
- B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.
- B. Provide electrical connections and service to items described in all other sections of these specifications.
- C. The Electrical Contractor shall provide all wiring and connections required to fire/smoke dampers. Coordinate exact locations of dampers with Mechanical Contractor and relay requirements with Fire Alarm Contractor.
- D. The Electrical Contractor shall provide all wiring and connections required to backdraft dampers at exhaust fans. Coordinate exact locations of dampers with Mechanical Contractor.
- E. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

1.04 WORK NOT INCLUDED

- A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.
- B. Unless otherwise indicated, motors shall be furnished by others, but connected by the Electrical Contractor as indicated on the Drawings.
- C. Unless otherwise specified, Mechanical equipment control low voltage wiring (less than 50 VAC) shall be provided and installed by the Mechanical Contractor.

1.05 SPECIFICATION TERMINOLOGY (Definitions)

- A. "Provide": Includes all material, installation, labor subcontracts, appurtenances and mark-up required for a complete operable system as shown and specified, set in place, connected and ready to use.

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- B. "Furnish": Purchase and deliver to job site, material as shown and specified.
- C. "Install": Includes all installation, labor subcontracts, appurtenances and mark-up required for complete installation of equipment furnished by others.
- D. **"Record Drawings": Drawings that reflect the electrical systems as actually constructed by the Contractor including conduit routing.**
- E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. All clearances per NEC.
- F. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- G. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit system.
- H. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, imbedded in construction, crawl spaces, etc.

1.06 DIAGRAMMATIC DRAWINGS:

- A. The drawings are in general diagrammatic, and the location of outlets, switches, motors, etc., on the drawings does not necessarily mean that such units shall be placed at that exact spot, as scaled on the drawings, but shall be located to function best. Use the drawings, and these specifications for guidance and secure the Engineer's approval of all changes in location. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.
- B. Verify all measurements at the site. No extra compensation will be allowed because of differences between locations shown on the drawings and measurements at the building.
- C. The Contractor is to draw electrical rooms and service to scale **(1/4" minimum)** with actual equipment to be used and submit to the Engineer prior to installation. The Contractor must insure that all minimum NEC working clearances are maintained. Coordinate with equipment of other trades.
- D. Where lighting fixtures and other electrical items are shown in conflict with structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.
- E. The branch circuits and arrangement of home runs have been designed to compensate for voltage drop and other considerations to accomplish maximum economy. Re-circuiting will not be permitted without specific approval. **Circuit numbers may change to achieve balanced loads on panels.**
- F. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- G. Drawings and specifications are complimentary each to the other. What is called for by one shall be as binding as if called for by both.

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- H. Should the drawings disagree in themselves, or with the specifications, the better quality or greater quantity of work or materials shall be used.
- I. Outlets and switches obviously placed in a location not suitable to the finished room or area shall be removed and relocated when so directed by the Architect at no cost to the Owner. The Architect shall have the right to make any reasonable change in outlet locations before rough-in without additional cost to the Owner. The contractor shall contact engineer when switches are inadvertently shown on hinge side of door prior to rough-in.
- J. Location of light fixtures shall be coordinated with reflected ceiling plans and/or room finish schedules.

1.07 MATERIAL AND EQUIPMENT SUBMITTALS

- A. Submittals: Provide submittals for all products and systems described in Division 26-28 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.
- B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) submittal number will be returned and required to be broken into unique separate submittal numbers.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.
- C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**
- D. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**
- E. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section.** Separate PDFs for each Submittal number.
- F. **HARDCOPY SUBMITTAL REQUIREMENT:** Hardcopy submittals will not be required by Engineer.
- G. **PDF SUBMITTAL REQUIREMENT:**
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected.**

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays cause by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

- H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**
- I. **Submittals will be returned in order of construction of the project, not necessarily in order submitted.** If all sections are submitted under one binder/at one time and transmittal, each section will be returned at the appropriate time for construction phasing. Electrical Gear will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Electrical Gear and Light Fixtures may require extended review time. **If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.**
- J. **DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS.** Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications submittal will be required. (Highlight items that are different to allow for proper review.):
 - 1. Devices
 - 2. Safety Disconnect Switches
 - 3. Wire and Cable
 - 4. All Motor Starters
 - 5. Contactors
 - 6. Lamps
 - 7. Photocells
 - 8. Time Clocks/Lighting Contactors
 - 9. Fuses
 - 10. Cable Tray
 - 11. Emergency Power (Inverter) System
 - 12. Cabinets and Enclosures
 - 13. Distribution and Fuse Blocks

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14. Fire Rated Product Penetration Details.
 15. Gear Coordination Study (include in O&M manual)
- K. **PDF Submittals Allowed** for Product Cut-Sheets for are limited to the following items:
Separate PDF file for each Submittal number is required. Follow file format above.
1. Fire Alarm System (Product Data and Shop Drawings)
 2. Interior Lighting Fixtures
 3. Exterior Lighting Fixtures
 4. Transformers
 5. Intercom and Sound System (Product Data and Shop Drawings)
 6. Dimming Systems
 7. Clock Systems
 8. Motor Control Center
 9. Bus Duct
 10. Power Conditions
 11. Surge Arrestors
 12. Generator Set
 13. Transfer Switch
 14. Emergency Power (Inverter) System
 15. Electric rooms (coordinate with mechanical). Also, indicate other equipment and/or systems on plan.
 16. Switchboards
 17. Panelboards
- L. When requested, present samples of all materials proposed for use to the Engineer for his approval.
- M. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.
- N. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.
- O. **Substitutions:** ("Substitution Request" form must be submitted)
1. Substitutions must be made and accepted PRIOR to Bid.

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2. Unless otherwise indicated, base bid on the equipment shown on the Drawings and hereinafter specified.
3. Request for approval to substitute materials, methods, or processes shall be made to Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.
4. All substitutions shall be of equal or better quality to the equipment specified.
5. Acceptance of the substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and completion of work on schedule.
6. It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity and other characteristics unless no substitutions are noted.
7. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**
8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**
 - a. Light Fixtures Packages
 - b. Alternate Transformers
 - c. Alternate Surge Protective Devices
 - d. Alternate Equipment/Gear Packages
 - e. Contractor Cost Savings Packages Requiring Substantial Review Time

1.08 SHOP DRAWINGS REQUIRED

- A. Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination.
- B. Architectural drawings must be used for backgrounds in preparation of shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

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C. Reference other specification for additional requirements.

1. Fire Alarm
2. PA System
3. Electrical Rooms

1.09 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the specifications.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDAS ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THIS REQUIREMENT IS MET.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the site construction office as the work progresses. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Indicate locations of all existing active and inactive conduit uncovered during construction. **Keep marked up set at site for review at site meetings.**

D. **Contractor to indicate conduit routing locations for all major runs and branch circuits under slab along with major junction locations.**

E. The Contractor shall be responsible for updating all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job the marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contractor shall provide pdf copies/scans for owner record purposes. Remove Engineer's seal from record drawings.

G. The Contractor shall bear all the costs of producing the "Record Drawing Set".

H. Electrical riser diagrams shall be laminated and mounted in the main electrical room or as directed by the Engineer.

1.10 CODES, REGULATIONS AND ORDINANCES

A. Comply with the requirements of the National Electrical Code, National Electrical Safety Code, Occupational Safety and Health Act (OSHA) and all other applicable Federal, State and local codes and ordinances. All codes and standards shall be per the latest adopted edition with all supplements and official interpretations included. Provide disconnecting means for all equipment per NEC. The Drawings and specifications take precedence when they are more stringent than codes, standards, ordinances, and statutes take precedence when they are more stringent or conflict with the Drawings and specifications.

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- B. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.
- C. All work shall also satisfy applicable local codes, ordinances, and regulations of the governing bodies, and all authorities having jurisdiction over the work. Where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Owner's representative and secure his approval before proceeding.

1.11 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

- A. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
- B. Retain all portable and detachable parts or portions of installation such as fuses, key locks, adapters, blocking clips, and inserts until final completion of work. Deliver parts to the Owner or his authorized representative and attach an itemized receipt to obtain request for final payment.
- C. Product Handling:
 - 1. Use all means necessary to protect the work and materials of this section before, during, and after installation and to protect the work and materials of all other trades.
 - 2. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.
 - 3. Store and protect materials and equipment in accordance with the manufacturer's recommendations.
 - 4. Provide suitable box or crate electrical equipment and cover with waterproof covers to protect against dirt, moisture or accidental damage during shipment or outdoors at the job site.
 - 5. Store all conduits on skids.

1.12 SERVICEABILITY OF PRODUCTS

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of piping, ductwork, equipment, conduits, junction boxes, panels and other products to allow proper service of all items requiring periodic maintenance or replacement.
- C. Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.

1.13 ACCESSIBILITY OF PRODUCTS

- A. Arrange all work to provide permanent, convenient and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

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- B. Provide access doors in ceilings, walls, floors, etc. for access to automatic devices and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.14 UTILITY COSTS

- A. Provide complete utility service connections. The locations and elevations of the various utilities included within the scope of this work have been obtained from city and/or other substantially reliable sources as a general guide only, without guarantee as to accuracy. Verify the locations, elevations, and availability of all utilities and services required, and be adequately informed as to their relation to the work.
- B. Include all service charges required by the electric utility or telephone/data/cable utility. Reference General Conditions for further information. Keep all utility company charges as a separate line item in bid. If cost is not available from utility company, indicate utility contact person, telephone number and **date of contact**.

1.15 CLEAN-UP

- A. Remove debris and waste materials from within the construction areas and transport off-site, daily.
- B. Keep the construction area clean, free from hazard, and orderly arranged.
- C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.
- D. Dispose of waste materials in accordance with all regulations which govern.
- E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.
- F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.
- G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Unless otherwise indicated, provide only new equipment and materials.
- B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.
- C. All materials furnished under these specifications shall be the standard product of manufacturer's regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.

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D. Guarantees:

1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect and shall remain in effect for a period of ONE (1) YEAR thereafter.
2. All materials, items of equipment, all lighting, and workmanship furnished under each section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.
3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.
5. Furnish, before the final payment is made, a written guarantee covering the above requirements.
6. Reference other guarantee information elsewhere in these specifications.

2.02 STANDARDS

- A. Where the Underwriters' Laboratories (UL) have established standards and issued labels for a particular group, class or type of material, apparatus, appliance or device, provide the UL label on all such items in that category incorporated into the work.
- B. Where such items are not covered by UL standards, they shall meet or exceed the requirements of the current National Electrical Code (NEC), or if not covered there, by the applicable, published, recognized standard of the American National Standards Institute (ANSI), or of the industry and of the related engineering society. Example: National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers (IEEE).
- C. Contractor is to follow the most current version adopted for all codes and standards.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

- A. Carefully lay out all work in advance so as to minimize cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, etc. Perform all cutting, channeling, drilling, etc., as required for the proper support, concealment, installation, or anchorage of raceways, outlets, or electrical equipment in a careful manner. Any damage to the building, structure, piping, ducts, equipment, or defaced finish, tile, plaster, woodwork, or metal work shall be repaired

by skilled mechanics of the trades involved at the Contractor's expense and to the satisfaction of the Engineer. All cutting, channeling, chasing, or drilling of unfinished masonry, tile, etc., or cutting, drilling, anchoring to or welding of structural members shall be performed in a manner having the Engineer's prior approval. All openings made in fire rated or smoke rated walls, floors, and ceilings shall be patched and made tight in a manner to conform to the fire rating or smoke rating for the enclosure.

- B. Where conduits pass through exterior walls, thoroughly caulk with sealant the annular space around the conduit to provide a watertight closure at the interior wall cavity and exterior wall surface. Provide $\frac{1}{4}$ " maximum annular space around the conduit. Provide and install all counterflashing of all conduit, pipe and supports which pierces roofs and other weather barrier surfaces. Verify detail with Architect before installation. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at his expense, to Architect's satisfaction. All waterproofing, flashing and counterflashing shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect and Roofing Contractor.

3.02 SEALING AND FIREPROOFING

- A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**

1. Only materials tested in the specific UL System No. may be used.
 - a. Caulk Manufacturer:
 - 1) 3M Type CP-25 W/B + for all assemblies requiring 3M caulk.
 - 2) For WL3045 and WL3046 use Hilti FS611A sealant.
 - b. Steel Sleeve (stud wall) (UL System No. WL1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum two inch (2") lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus one inch (1") such that, when installed, the ends of the sleeve will project approximately $\frac{1}{2}$ " beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with conduit) to be 2 to 2- $\frac{1}{2}$ " larger than the outside diameter of conduit such that, when the steel sleeve is installed, a 1 to 1- $\frac{1}{4}$ " annular space will be present between the steel sleeve and the conduit around the entire circumference of the conduit. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.
 - c. Optional Steel Sleeve (concrete or block wall): Except for single insulated cables, provide sleeve cast in floor/wall or mortared into CMU wall; Schedule 40 or heavier, length to extend a maximum one inch (1") from top surface of floor or a maximum of one inch (1") from both sides of wall.

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- d. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.
- 2. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies and one (1) side of floor.
- 3. Alternate floor penetration system (with firestop mortar): UL System No. CAJ1032.
- 4. Wires and Cables:
 - a. For gypsum frame wall, single cable: Fireproof per UL System No. WL3001. Opening for cables to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).
 - b. For gypsum frame wall, multiple cables: Use UL system No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.
 - c. For concrete walls/floors or CMU walls, single or multiple cables: Fireproof per UL System No. CAJ3030. Install sleeve in assembly flush with both sides. Cables to be a minimum of ten percent (10%) and a maximum of thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.
- 5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.
- 6. Materials used in firestop systems shall be installed in accordance with the manufacturer's written instructions (shall be posted at job site, in General Contractors trailer), provided with materials for specific UL System No.
- 7. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield or equal.
- B. In non-rated walls identified for sound insulation, provide 1/2" space between conduit and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.
- C. **Final condition to prevent passage of fire, smoke, noxious gas and water.**
- D. For non-rated electrical/mechanical rooms: Seal all conduit passing through room walls, floors and ceilings with 3M caulk, Type CP-25 WB+.

3.03 WORKMANSHIP AND COMPLETION OF INSTALLATION

- A. For the actual fabrication, installation and testing, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation. In acceptance or rejection of the installed work, no allowance will be made for lack of skill on the part of workmen.

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- B. Install all specialties as detailed on plans. Where details or specific installation specifications are not included herein, follow approved manufacturer's recommendations.
- C. Install complete, thoroughly check, correctly adjust, clean, and leave ready for operation all equipment and material connected with this project.
- D. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.
- E. Electrical service stub locations, sizes and quantities for equipment are approximate only. The Contractor must verify all service locations, sizes and quantities with the equipment supplier before rough-in.
- F. The Electrical Contractor shall make all final connections to all electrical equipment furnished and set in place by others, including millwork with outlets. The Electrical Contractor shall provide and install all disconnect switches as required.
- G. The Electrical Contractor shall provide/install all circuit breakers, power wiring, conduit systems and final connections required for operation of heating cable systems.
- H. Provide and install all adjustable mounting brackets, steel bar hangers, T-bar mounting clips, support channels and universal support bridges as required for installation of recessed light fixtures, speakers, alarm devices and other ceiling mounted devices. Ceiling tile shall not be used to support ceiling mounted devices in lay-in ceilings.
- I. Provide wood trim for any semi-recessed panels installed. Verify finishes with the Owner/Architect.
- J. Provide Hoffman enclosure (#A-244208WFLP) wall mounted at location shown on plans. Provided in enclosure shall be spare fuses, three (3) of each amperage used in project up to 100 amp size and spare smoke detectors (see Section 28 31 00.)
- K. Equipment and materials shall be listed by an organization that evaluates products and states that the equipment or material, either meets appropriate designated standards or has been tested and found suitable for a specified purpose or shall be labeled by the manufacturer to indicate compliance with appropriate standards or performance in the specified manner to be used.
 - 1. Listed or labeled equipment and materials shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned in accordance with any instructions included in the listing or labeling.
- L. The installation shall be performed by licensed, competent workmen to provide a thorough and complete installation.
- M. All work shall be accomplished in conjunction with other trades in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.
- N. Exact locations shall be determined by reference to the general plans and measurements at the building and shall be subject to reasonable change by the Owner's representative without additional cost.
- O. Prior to and during construction, provide adequate storage facilities and properly protect items subject to any damage. Failure to comply with this provision will be sufficient cause for the rejection of the particular apparatus involved.

RESTROOM BUILDING

- P. At completion, the installation shall be thoroughly cleaned. All tools, equipment, obstructions, temporary power, temporary lighting and debris shall be removed from the premises.

3.04 BALANCING SYSTEM

- A. Balance the electrical system between the respective phases of the system. Balance individual circuits in each panel of the system. Where phase assignments or circuit numbers are indicated on the drawing, do not deviate without the Engineer's approval. All deviations shall be noted on panelboard submittals and on Record Drawings and schedules

3.05 COOPERATION WITH OTHER CONTRACTORS

- A. Cooperate with other Contractors so that the installation of the electrical materials and equipment may be properly coordinated. Where a conflict occurs with piping, duct work, etc., it shall be resolved as directed by the Engineer.
- B. Interferences between conduit and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed:
 - 1. Building Lines
 - 2. Structural Members
 - 3. Drainage Waste and Vent Piping
 - 4. Refrigerant Piping
 - 5. Ductwork
 - 6. Water and Gas Piping
 - 7. Electrical Conduit
 - 8. Fire Protection Piping

3.06 COORDINATION OF WORK

- A. Each Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing inter-related work. Before installation, all Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Locations of conduit and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of systems shall be determined prior to fabrication or installation.
- C. Offsets and changes of direction in all conduit systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.
- D. Where discrepancies in scope of work as to what Trade provides items such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems.

RESTROOM BUILDING

- E. Verify voltage, phases, termination points, termination requirements and required disconnects for all equipment provided as part of this contract or equipment furnished by Owner prior to rough-in. Report any discrepancies to Architect/Engineer.
- F. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.
- G. **The Electrical Subcontractor shall verify with HVAC, Plumbing and Fire Protection Subcontractors the required electrical characteristics for all motors and equipment before ordering and submitting of electrical gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**

3.07 SAFETY PRECAUTIONS AND PROGRAMS

- A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

3.08 OPERATING AND MAINTENANCE MANUALS

- A. Provide one (1) Operation and Maintenance manuals for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records
- B. Operating Sequence and Procedures:
 - 1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter.
 - 2. Typewritten Operating Procedures: Write procedures for start-up, operation and shutdown.
 - a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.
 - 3. Shutdown Procedures: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

RESTROOM BUILDING

- C. Maintenance Instructions:
 - 1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.
- D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide the nearest manufacturer's representatives name, address and phone number.
- E. Shop Drawings: Provide two copies of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturer's brochures or properly identified in a separate subsection.
- F. Spare Parts Lists: Include a list of all equipment furnished for the project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or systems. Properly identify each part by part number and manufacturer.

3.09 IDENTIFICATION

- A. Equip the following items with nameplates:
 - 1. Motor Starters
 - 2. Main Switchboard and Overcurrent Devices and Spares
 - 3. Panelboards and Branch Circuits
 - 4. Safety Disconnect Switches
 - 5. Contactors
 - 6. Control/Power Equipment in Separate Enclosures Including Relays
 - 7. Bypass Switches and Transfer Switches
 - 8. Emergency Generator Sets
 - 9. UPS System and Battery Racks
 - 10. Motor Control Centers
 - 11. Transformers
- B. No dymo (stick on indented plastic) type label will be permitted.
- C. Identify equipment listed above. COORDINATE EQUIPMENT NUMBERS WITH MECHANICAL AND/OR KITCHEN PLANS. Each piece of equipment shall be numbered consistently throughout.
- D. Fabricate nameplates as follows:
 - 1. Provide three (3) ply, 1/16" laminated plastic nameplate material with white core for lettering and black background. All nameplates, for equipment powered from emergency circuits, shall have white core for lettering and red background.

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2. Use capital letters.
 3. Unless otherwise indicated, provide minimum 3/4" high x 2" long nameplates with 1/4" letters.
 4. All labels shall be permanently affixed to the front of all required equipment using two (2) round head self tapping screws. Self-adhesive labels are not acceptable. Align labels with equipment.
- E. All junction boxes shall have the panel/circuit number(s) identified on the blank coverplate, handwritten with a permanent black marker. Disconnects, combination motor starter/disconnects and manual motor starter shall have the panel/circuit number(s) identified on the inside of the front cover, hand written with a permanent black marker.
- F. Provide engraved coverplates for all switches and control devices which are not otherwise clearly related to the equipment they serve.
- G. Label all receptacles and light switches with circuit number using electronic labeler (black on clear). Install label level on front of face plate for receptacles and back side of face plate for light switches.**
- H. Spray paint J-Boxes red for Fire Alarm System. All other special systems J-Boxes to be painted white.
- I. Color code all 600 volt insulated conductors by installing conductors with factory colored insulation for conductors No. 10 AWG and smaller.
- J. Install colored tape on all 600 volt conductors No. 8 AWG and larger. Apply tape 6 inches from terminal points. Do not cover factory applied cable identification markings with taping; tape locations may be adjusted slightly to prevent the covering of factory markings. Tape shall be Scotch No. 35 or approved equal, 7-mil thick by 3/4" wide vinyl adhesive tape.
- K. Install engraved plastic laminate nameplates as listed below.

EQUIPMENT	LETTERING SIZE	INFORMATION
Switchboards, Panelboards, MCCs and other distribution system overcurrent devices	1/4" / 1/8"	Switchboard name designation, ampere rating of the supply conductors, voltage characteristics, power source and room number(s). EX: MDP, 1900A, 480Y/277V, Served from Utility EX: HVA, 175A, 480Y/277V, source DP-1,3,5. in Room 100.
Transformers	1/4" / 1/8"	Transformer name designation, load served, power source and room number(s). EX: Trans. TR-1, serves PANEL LV-1, source DP-7,9,11 in Room 203.
Remotely mounted Safety Switches and Starters	1/8"	Load served, power source and room number(s). EX: HWP-1, HVA 37,39,4 1 in Room 203. EX: PANEL LV-2 in Room 303, source TR-2.
Contactors	1/8"	Load served, power source and room number(s). EX: Room 502, Science Lab, LVA 31,33 35, 37,39,4 1. EX: Building security lights, HVA 2, 4. EX: Parking lot lights, HVA 6, 8, 10.

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- L. Prepare a neatly typed panelboard circuit directory. Identify all circuits by the equipment served and by the room number, room numbers may be different from those shown on drawings. Verify room numbers prior to typing directories. Indicate spares and spaces with light, erasable pencil marking.

3.10 TESTING

- A. Test and record results for all power feeders for Megger Readings, including phase to phase and phase to ground as recommended by the cable manufacturer.
- B. Measure and record service ground resistance.
- C. For equipment having ground-fault protection the ground-fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be submitted to the Engineer and a copy put in the Operation and Maintenance Manuals.

3.11 CERTIFICATE OF COMPLETION

- A. Submit, at time of request for final inspection, a completed letter in the following format:

I, (Name) , of (Firm) , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of (Date). I further certify that the following specification requirements have been fulfilled:

1. Megger readings performed, six (6) copies of logs attached.
2. Ground tests performed, six (6) copies of method used and results attached, including service ground readings and ground fault test results.
3. Operating manuals completed and instructions of operating personnel performed for all systems, (Date) , (Signature, Owner's Representative).
4. Record drawings up-to-date and ready to deliver to Engineer.
5. Fire alarm system final connections, check-out and start-up completed on (Date) by (Signature, Factory Authorized Representative and Trained Technician) .
6. All other tests required by Specifications have been performed.
7. Final clean-up is completed.
8. All systems are fully operational.

Signed: _____

3.12 SITE OBSERVATION

- A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.

- B. **It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense, billed at current Engineer's hourly rates.**
- C. The final acceptance of the work will be made jointly by the Architect and the Owner.
- D. Time spent for Investigation/Site Trips due to Contractor lack of installation capabilities/skills or knowledge is not part of Engineer's scope. Therefore time spent assisting contractor in these matters or problems that arise due to these matters will be billed to Contractor. Engineer will bill the contractor at the current hourly rates of the Engineer. These fees will be paid in full prior to release of contingency.

3.13 DURING FINAL INSPECTION

- A. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.
- B. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.

3.14 CLOSE-OUT DOCUMENTS:

- A. Furnish three signed letters of guarantee.
 - 1. Clearly and individually, document all material, equipment and service guarantees beyond a single year.
- B. Furnish one original and two copies, of a statement from the inspecting authority stating that the installation has been accepted and approved.
- C. Furnish one reproducible, two copies and an electronic "AutoCad" version, of complete, full-size sets of drawings showing conduit locations by accurate dimensions from permanent structures.
 - 1. **"Record Drawings"** are to include:
 - a. A sheet legend shall be present on the 1st sheet of the required set which identifies each sheet making-up the set.
 - b. Site plan(s) with primary and secondary electric power and communication lines to the property line (may be a civil sheet).
 - c. Site plan(s) with all underground conduits to other buildings, structures, fixtures and equipment.
 - d. Marked-up electrical plans and schedules.
- D. Furnish three complete sets of overload settings and motor data records.
- E. Furnish three complete sets of the electrical testing results.
- F. Furnish three complete sets of the power system study final report.
- G. Furnish all manufacturer's software if required for start-up or modifying products furnished.

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- H. Furnish two complete sets of the AC Drive's comprehensive manual that includes operation, programming, diagnostics, applications, wiring diagrams, layout diagrams, and outline dimensions.
 - 1. Identify each AC Drive's model number on a cover sheet.
- I. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format.

MEP/ENERGY CONSULTANTS



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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

- A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.
- B. 2 Submittal CATEGORIES (Reference Specifications)
 - a. Not required unless deviating from specification
 - b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:

For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures

Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:

Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

JOB NAME – RFI No. XX – RFI DESCRIPTION

- C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.
- D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

- a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

- b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

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- E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.
- F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.
- G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.
- H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."
- I. Call before submitting a written RFI.
- J. All formal Job emails must come from Architect.
- K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

- A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.
- B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.
- E. Schedule and Details sheets will not be released.

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SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

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The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph: _____

Drawings and Details Affected: _____

Proposed Substitution/Description: _____

Installer's Name: _____

Manufacturer's name: _____

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____ # of pages including cover)

Why is Substitution Being Submitted?

- ☐ Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
- ☐ Specified product is not available. Explain in detail as attachment.
- ☐ Cost Savings to Owner. Indicate comparative cost analysis as attachment.
- ☐ Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

- A. Does substitution affect dimensions shown on drawings? ☐ No ☐ Yes
- B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐ No ☐ Yes
- C. What affect does substitution have on other trades?
- D. Differences between proposed substitution and specified item?
- E. Indicate how proposed substitution meets LEED requirements. (if applicable)
- F. Manufacturer's guarantees of proposed and specified items are:
- ☐ Same ☐ Different (explain on attachment)

The Contractor and Subcontractor certifies:

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

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

For A/E Use: SR# _____

- ☐ Accepted ☐ Accepted as Noted
- ☐ Not Accepted ☐ Received Too Late
- ☐ Incomplete Information
- ☐ No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:

- ☐ FILE ☐ OWNER ☐ CONTRACTOR
- ☐ ENGINEER ☐ _____

MEP/ENERGY CONSULTANTS



COMMISSIONING • FIELD INVESTIGATIONS

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 Round Rock, Texas 78664
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 (512)218-0077-fax

SECTION 26 05 10 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall breakdown the final Schedule of Values to be used for pay application into the following minimum categories.
- B. ALL CATEGORIES SHALL HAVE APPROPRIATE MATERIAL AND LABOR BREAKDOWN.**
- C. Definitions:
 - 1. Service: Conduit for utility company and conduit and wire from utility transformer to main switchboard.
 - 2. Feeders: Include all conduit and wire serving transformers and panelboards.
 - 3. Branch Circuit: Any circuit from a panelboard to a utilization device.
 - 4. Gear: Main switchboard, panelboards, transformers, disconnects, etc.
 - 5. Site conduit voice/data.

1.02 SCHEDULE OF VALUES

- A. Mobilization
- B. Utility Company Fees
- C. Service - Wiring and Conduit
- D. Site Light Fixtures, Wiring and Conduit
- E. Gear
- F. Interior Lighting Fixtures
- G. Branch Circuit - Wiring and Conduit
- H. Feeders - Wiring and Conduit
- I. Devices (switches and receptacles)
- J. Uninterruptible Power System
- K. Testing/Labeling of Equipment
- L. Record Drawings and O&M Manuals (\$1500 minimum)

END OF SECTION

SECTION 26 05 19 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide a complete system of conductors in raceway systems as shown on the drawings and hereinafter specified. Route all wire through an approved raceway unless otherwise indicated, regardless of voltage application.
- B. Provide 200% neutral conductors to all panels with 200% neutral specified. Reference Panel Schedules.
- C. Provide individual neutrals for each circuit, no shared neutrals allowed.**
- D. No de-rating of neutrals allowed.**

1.02 STANDARDS

Provide conductors in accordance with the applicable sections of UL and IPCEA Standards.

1.03 SUBMITTALS

- A. Furnish Engineer shop submittals for each type of wire and cable.
- B. Provide shop submittals which includes the following information:
 - 1. Insulation type.
 - 2. Insulation temperature rating.
 - 3. Manufacturer

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wire and Cables: (600 Volts)
 - 1. Provide copper wire and copper ground conductors **only**. Conductors shown on plans are thusly sized. **No aluminum conductors** will be allowed unless specifically noted.
 - a. Minimum wire size for branch circuits shall be #12, however, #14 may be used for motor control circuits where specified on the drawings.
 - b. All conductors #12 and smaller shall be solid and #10 and larger shall be stranded.
 - 2. Provide copper conductors of annealed, 98 percent conductivity soft drawn copper. Provide stranded conductors for control circuits.
- B. Metal clad cable shall not be acceptable except from junction box to light fixture, maximum 6 feet in length.**

C. Flexible metal conduit or metal-clad cable for receptacles and branch circuits with the following limitations:

- 1. Dry interior locations;**
- 2. Feeds one outlet only or first outlet.**
- 3. 20 amp maximum;**
- 4. Both segment ends are located within the same room.**
 - a. One segment end at the outlet box and the other segment end at a ceiling junction box located, within 10 feet of the entrance into the wall cavity, vertically above the outlet served.**
- 5. Where installed in an insulated wall, the cable must be on the conditioned side of the insulation and;**
- 6. Each cable or conduit shall be supplied by only one (1) branch circuit breaker (one, two or three poles).**
- 7. No MC to be horizontal in wall. All horizontal runs must be pipe and wire only.**

D. Insulation: (600 Volts)

1. Provide all conductor insulation types rated for wet and dry locations and approved by the National Electrical Code for the particular application. Provide all wire and cable with the following (or better) insulation classes:
 - a. All feeders and branch circuits are to be dual-rated Type THHN/THWN **copper** conductors.
 - b. Insulation rated for operation at 600 volts.
 - c. In areas where the temperature will exceed 167°F, provide wire rated 105°C. minimum and a type approved by the local code. Include any wiring within three feet (3') horizontally or ten feet (10') above any heating appliance.
2. Color code in accordance with the wiring diagrams furnished with equipment. All wiring for control systems to be installed in conjunction with mechanical and/or miscellaneous equipment. Color code by line or phase all branch circuit wiring including circuits to motors and feeders as follows: Wire No. 10 and smaller shall be factory color coded. Wire No. 8 and larger may be color coded by color taping within six inches (6") of exposed ends. **Color coding for each nominal voltage shall be consistent throughout building from point of origination to the termination point including tap conductors to luminaire. Mixing of colors between voltages will not be allowed.**

120/208 Volt
Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White
Ground - Green

120/240 Volts
Phase A - Red
Phase B - Black
Phase C - Orange
Neutral - White
Ground - Green

277/480 Volts
Phase A - Brown
Phase B - Yellow
Phase C - Purple
Neutral - Gray
Ground - Green

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- E. Wire and Cable: (50 volts or less)
 - 1. Provide copper wire, minimum size #18 AWG for controls, #18 AWG minimum for fire alarm and #20 AWG minimum for communications. All wire and cable shall be solid. Stranded conductors are not acceptable.
 - 2. All conductors shall be routed in conduit or shall have an insulation approved for plenum installation, unless otherwise noted.
- F. ROMEX not allowed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Unless otherwise indicated wiring size noted on the drawings extend for the entire length of a circuit. Install wire in raceways in strict conformance with the manufacturer's recommendations. Use a UL approved wire-pulling lubricant. Strip insulation so as to avoid nicking of wire.
- B. Wire Connections and Devices:
 - 1. Provide all terminating fittings, connectors, etc., of a type suitable for the specific cable. Make all fittings up tight. Make up all terminations in strict conformance with manufacturer's recommendations using special washers, nuts, etc., as required.
 - 2. Connect No. 8 and larger wire to panels and apparatus with properly sized, solderless, or compression lugs or connectors.
 - 3. Join No. 10 and smaller wire by twisting tight and applying UL listed twist-on connectors.
 - 4. Leave at least an eight inch (8") loop of wire for ends at each outlet box for the installation of fixtures or devices.
- C. Flashover or insulation value of joints shall equal that of the conductor. Provide connectors rated at 600 volts for general use and 1000 volts for use within fixtures.
- D. Grouping shall be 3 Hots and 3 Neutrals or 6 Hots max. Derating shall be based on the 90 degree chart of NEC 310-16 and table 310.15 (B)(2)(2).
- E. Where the distance between the supplying panel and the first branch circuit receptacle, light fixture or equipment is more than 100 feet, upsize wire to allow for maximum of 3% voltage drop for actual routing of conduit to device.
- F. Wiring for emergency systems shall be kept entirely independent of all other wiring and equipment as required by Article 700 of the NEC.
- G. Mechanically protect conductors by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use an approved wire-pulling compound when pulling conductors. Wiring pulling compound shall be listed and as recommended by the conductor manufacturer. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of the insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension.

RESTROOM BUILDING

- H. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.
- I. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- K. Neatly and securely bundle all conductors in enclosures using nylon straps with a locking hub.
- L. At least 6 inches (measured from the finished surface) of each conductor shall extend outside a box's opening.

3.02 SPLICES AND TERMINATIONS

- A. Splices shall be kept to a minimum.
- B. Splices shall be made in junction and/or pull boxes.
 - 1. Splices in conduit fittings (i.e., conduit bodies), and in panelboards are not acceptable.
- C. All materials shall prevent corrosion or electrolysis between dissimilar metals.
- D. Use terminal blocks within a junction box for all splices of No. 6 and larger conductors.
- E. Use mechanical, crimp or compression type connectors for terminations of stranded conductors.

3.03 CONDUCTOR SIZING

- A. Install conductor size required by the more stringent requirements of the drawings or specifications.
- B. Install No. 10 AWG conductors the entire length of the circuit for single-phase, 120-volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 100 feet.
- C. Install No. 10 AWG conductors the entire length of the circuit for single-phase 277 volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 200 feet.
- D. General use circuit numbers may be changed. Equipment circuits have numbering to balance loads. This contractor is responsible for maintaining a balanced load and recording the actual circuit numbers.
- E. Comply with ampacity adjustment factors as required by the NEC Article 310-16.

RESTROOM BUILDING

3.04 TESTING

- A. Prior to energizing feeders, perform insulation resistance tests at 500 Volts D.C. for 30 seconds on each cable with respect to ground and adjacent cables. Maintain the following log for feeder tests:

FEEDER DESCRIPTION: _____

TESTER'S NAME: _____

TEST INSTRUMENT SERIAL #: _____

TEST DATE: _____

RESISTANCE:

A-B

A-C

A-G

B-C

B-G

C-G

- B. Test all circuits for proper neutral connections.
- C. Upon completion of all testing, prepare a detailed report of all voltage and insulation resistance measurements. Deliver report to Engineer with request for final inspection.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide copper clad 5/8" x 8 ft. - 0" long ground rods, appurtenances, bonding plates, clamps, connectors and grounding conductors as required. Furnish rods to which the copper cladding is permanently and inseparably bonded to a high strength steel core.

2.02 CONNECTORS

- A. Provide exothermic weld type ground connections for concealed, underground, and concrete encased ground connections.
- B. Exposed connections may be made with copper or bronze bolted or compression lugs.

2.03 INTER-SYSTEM GROUNDING BUS-BAR (communications)

- A. Provide surface mounted terminal blocks sufficient to except 20 individual conductors of sizes 14 AWG thru 4 AWG.

2.04 CONDUCTORS

- A. Furnish copper conductors.
- B. Furnish 600-volt, insulated conductors for equipment grounding.
- C. Size the system grounding electrode conductors to comply with NEC section and table 250-66, unless shown larger.
- D. Size the main and separately derived system bonding jumpers to comply with NEC section 250-28 (D).
- E. Size equipment grounding conductors to comply with NEC section and table 250-122, unless shown larger.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Properly ground all service equipment conduit systems, supports, cabinets, equipment, motor frames, fixtures, etc., and the grounded circuit conductor in accordance with the latest issue of the National Electrical Code. Provide all bonding jumpers and wire, grounding bushings, clamps, etc., as required for complete grounding. Route ground conductors to provide the shortest and most direct path to the ground electrode system. Bond conduit if made of current conducting material. All ground connections shall have clean contact surfaces. Bond the service equipment to a grounding electrode as shown on the Drawings.

RESTROOM BUILDING

- B. Provide a grounding type bushing for all feeder and branch circuit conduits which do not have a grounding conductor and individually bond this raceway to the enclosure's ground bus or lug.
- C. Provide a grounding type bushing on the end of each isolated section of metal conduit and bond the conduit to the equipment grounding conductor, or using a conductor of the same size, bond directly to the equipment ground buss of the equipment at the end of the run.
- D. Make single or dual connections to ground rods, plates, and other buried connections by the exothermic process (Cadweld) or Burndy Hyground TM Compression Systems and "hammer tested" to insure that a good bond has been made. Alternatively, all below grade compression grounding systems must meet all UL467, CSA, IEEE837 test requirements and conform to the National Electrical Code Standards. The material at the connectors shall be pure wrought copper extrusions, rod and seamless tubing and be identical material to the conductor. Connectors must be of heavy duty design and be of range taking design to accept conductor ranges of #6 solid to 500 Kcmil plus 5/8" ground rods. Compression connectors need to be compressed with system engineered tooling which makes a circumferential or round crimp. Hex crimp is not acceptable due to sharp flashes and spurs that may occur. Each connector must be clearly marked with catalog number, conductor size and installation die information. Inspection ports must be provided on lug terminations and splices. The system must emboss all the appropriate die index numbers on all connectors after completion of the crimp. Connectors must be prefilled with penetrox copper type oxidation inhibitor and be individually sealed in clear polyethylene sheet to keep out dirt and contamination.
- E. Drive grounding electrodes as required. Where rock is encountered, grounding plates of copper, 1/4-in. x 24-in. x 24-in may be used in lieu of grounding rods. Plates must be installed at 36" minimum below finished grade.
- F. Connect grounding electrode conductor to building steel and metallic waterline per NEC 250-81. Allow a minimum of 25 feet of grounding conductor in foundation footing and make 3 connections to Rebar. Connections shall utilize an acceptable compression method with connectors listed for contact with respective metal types.
- G. Provide a grounding terminal pad in all panelboards, switchboards, and other electrical equipment.
- H. Directly ground to the work piece welding machines used in construction. The use of the building or equipment steel or conduits of any kind as a common ground point is not allowed under any conditions. Contractor is responsible for any electrical pieces of equipment damaged by not using the welder grounding method described above.
- I. Provide a green insulated grounding conductor in all conduit serving receptacles and/or equipment. Refer to panelboard schedules for sizing.
- J. Ground all receptacles to outlet box with a conductor.
- K. Flexible conduit will not be allowed as a grounding means.
- L. Install metallic fittings on clean contact surfaces to ensure electrical conductivity.
- M. Tighten connectors, terminals, screws and bolts, in accordance with manufacturer's published torque tightening values or comply with torque tightening values specified in UL 486A to assure permanent and effective grounding.

RESTROOM BUILDING

- N. Apply a corrosion-resistant finish to places where factory applied protective coatings have been damaged.
- O. Protect all exposed, grounding electrode conductors with Schedule 40 PVC nonmetallic conduit.
 - 1. Grounding electrode conductors shall not be protected with metallic materials.

3.02 GROUNDING ELECTRODE SYSTEM

- A. At each building's service or disconnecting means install a grounding electrode system which includes;
 - 1. A concrete encased electrode connected to the concrete reinforcing bars and;
 - 2. The building structural steel and;
 - 3. The building's metal underground (10 ft.) water pipe.
 - a. This connection must be within the first 5 ft. of the water pipe's entrance into the building. Water piping cannot be the sole ground and must be supplemented.
 - 4. Other electrodes such as a rod, plate or ring may be used to supplement but cannot be used as a substitute.
- B. At each grounded separately derived system install a grounding electrode conductor to connect the grounded (XO-neutral) conductor to;
 - 1. The nearest one of the following electrodes:
 - a. An effectively grounded structural steel member or;
 - b. An effectively grounded metal underground (10 ft.) water pipe.
 - 1) This connection must be within the first 5 ft. of the water pipe's entrance into the building.
 - 2. If neither of these is available, install a 3/0, copper, common grounding electrode conductor from the building's service or disconnecting means. Connect taps from this common grounding electrode conductor to the separately derived system's grounded (XO-neutral) conductor.

3.03 SYSTEM BONDING

- A. SERVICES
 - 1. Install a main bonding conductor between the service ground bus and the grounded (neutral) bus-bar.
- B. SEPARATELY DERIVED SYSTEMS
 - 1. Install a bonding jumper between the equipment ground bus and the separately derived electrical system's (transformer, UPS, central battery/inverter or generator) grounded (XO-neutral) bus.

RESTROOM BUILDING

3.04 ADDITIONAL BONDING

- A. Install 3/0 AWG bonding jumpers around all structural metal expansion joints.
- B. Each building's interior metal water piping system which does not qualify to be used as a grounding electrode shall be bonded to the building's service or disconnecting means.
- C. Bond the grounded (XO-neutral) conductor of each separately derived system to the nearest available point of the interior metal water piping system(s).
 - 1. When the structural steel is being used as the grounding electrode for the separately derived system the interior metal water piping system(s) may be bonded to the structural steel.
- D. Install bonding jumpers around raceway expansion joints.
- E. Install bonding jumpers around insulated water pipe joints.
- F. Install a bonding jumper between all grounding electrodes used for communications, radio and television or antenna systems and the building's grounding electrode system.

3.05 COMMUNICATION GROUNDING

- A. Provide a surface mounted, inter-system grounding bus-bar at the service equipment or a separate building's disconnecting equipment and in each communications room.
- B. At the service or separate building's disconnecting means, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the equipment ground bus.
- C. At communications rooms, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the building's structural steel.

3.06 EQUIPMENT GROUND

- A. Raceways shall not be used as the sole equipment ground.
- B. Bond the equipment grounding conductors to all boxes and enclosures.
- C. Each receptacle shall be bonded to its respective device box. The connection shall be made by means of a bonding jumper between the device and the box. Where the receptacle mounting yoke is designed and listed for the purpose of grounding; the bonding jumper may be omitted. This does not substitute for the need of grounding the outlet box.
- D. Each isolated ground receptacle shall have an isolated ground conductor installed complete from receptacle to the isolated ground bus in the panelboard. No other grounding connections shall be made to these receptacles, specifically connections to the device box or raceway system.

3.07 TESTING

- A. Following completion of installation, test system ground for continuity and test resistance to ground by "fall of potential" method and all feeders or sub-feeders with appropriate meggers, or other approved instruments and methods, to determine ground and insulation resistance values.

RESTROOM BUILDING

- B. Submit logs of values obtained, nameplate data of instruments used and instrument calibration data prior to final inspection. Instruments used are subject to acceptance.

END OF SECTION

SECTION 26 05 29 – HANGER & SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all required supporting devices, including but not limited to channels hangers, brackets, fittings, clamps, hardware, anchor bolts, rods, electrical accessories, etc., for conduit and equipment.

1.02 STANDARDS

- A. Conform with the latest requirements of the NEMA and The National Electric Code.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Support Channel: Hot-dipped galvanized steel, sized for load, minimum size 12 gauge, 1-5/8 wide by 13/16 deep. Furnish fasteners sufficiently sized to carry load imposed.
- B. Hardware: Corrosion Resistant (Hot-dipped galvanized all steel components)
- C. Support Wires (16 Ga. Minimum) and Tie Wires (22 Ga. Minimum) or as required by UL listed assemblies: Galvanized Steel
- D. Coatings: All steel components shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Perforated iron straps are not permitted for supporting conduits. Conduits run between the webs of bar joists may use galvanized tie wire for securing the conduits. Cut excess wire and bend ends to prevent sharp ends.
- B. Support horizontal and vertical conduit runs by one-hole straps, clamp-backs or other acceptable devices and suitable bolts. All conduits shall be secured to structure with supporting devices dedicated for the electrical system and/or conduits for systems furnished under the Electrical Contractor responsibilities. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers, equal to the Modern Co. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.
- C. All conduits shall be supported a maximum of ten feet (10') on center. Also, support conduits within twelve inches (12") of any bends, outlet boxes, wall penetrations or joints in pipe. All conduits shall be secured to structure. Lighting fixture whips may not be secured to ceiling tie wires. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines
- D. Conduits routed below bar joists shall utilize acceptable clamps.

RESTROOM BUILDING

- E. Fasten hanger rods, conduit clamps and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, or beam clamps. Do not use spring steel clips and clamps. Submit method of attachment for review prior to commencing work.
- F. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheetmetal screws in sheetmetal studs; and wood screws in wood construction.
- G. Do not fasten support wires to piping, ductwork, mechanical equipment or conduit.
- H. **Do not fasten conduit or junction boxes to ceiling grid wire. All conduit must be independently supported.**
- I. Support recessed fluorescent light fixtures with support wire at all four corners as required by roof/ceiling assembly. If roof/ceiling assembly does not require supports at each corner, support fixtures with minimum of two support wires at diagonally opposite corners. Spray paint ends of fixture support wires orange.
- J. Conduits, except as approved by NEC, shall not be used to support low voltage cables.
- K. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for conduit 2-1/2" and smaller. For conduit over 2-1/2", up to and including 4" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All conduit stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 3-1/2"). Provide supports for piping under 2" at six feet on center. Provide supports for conduit 2" and over at eight feet on center.
- L. Provide all angles, unistrut supports and threaded rods under any structural elements or mechanical equipment where required for proper placement and support of light fixtures and/or conduits.
- M. Supports and hangers shall be installed to permit free expansion and contraction in the raceway systems. Where necessary to control expansion and contraction, the raceways shall be guided and firmly anchored. Anchors shall be approved by the Engineer and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No conduit shall be self-supporting, nor shall it be supported from equipment connections. Transmission of vibrations, noise, etc., shall be considered and any special suspension with vibration dampers to minimize transmission shall be used where necessary.
- N. Where ducts interfere with the proper location of hangers, furnish and install trapeze hangers. Trapeze hangers may be used to support groups of conduit run in parallel.
- O. Install metal framing to support wall mounted equipment and wall or ceiling mounted raceways.
- P. Install expansion bolts to attach framing to concrete. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.
- Q. Touch up all scratches or cuts on steel components with an approved zinc chromate or a 90 percent zinc paint.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide a complete conduit system as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

Conform with the latest requirements of the NEMA, the National Electrical Code, and be UL listed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Rigid Metal Conduit (RMC): Hot-dip galvanized, threadable steel raceway, galvanized after fabrication. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.
- B. Intermediate Metal Conduit (IMC): Conduit shall be similar to rigid steel conduit except thinner wall. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.
- C. Electrical Metallic Tubing (EMT): EMT shall be made of hot-dip galvanized strip steel. Fittings shall be die cast compression or set screw type.
- D. PVC - Schedule 40 and Schedule 80 polyvinyl chloride conduit (PVC Duct) shall be UL rated. Conduit fittings and cement shall be produced by the same manufacturer and approved for such use.
- E. Flexible Metal Conduit (FMC): Spirally wound continuously interlocked zinc coated strip steel. Fittings shall be die cast zinc, either screw-in or squeeze type.
- F. Flexible Conduit (LFMC): Liquid-tight (vibration and/or wet areas) fabricate from continuous lengths of spirally wound galvanized steel strip interlocked with a gray polyvinyl chloride cover extruded over the core to make the conduit liquid tight, oil proof and bendable to a small radius. Fittings shall be compression type, die cast zinc, with insulated throat.
- G. Metal-Clad Cable (MC): Galvanized interlocking steel armor. 600 volt, type THHN/THWN, integrally colored insulation. Size #12 AWG or #10 AWG, copper conductors. Fittings shall be listed for MC usage and include anti-short bushings. Reference Section 3.03 for acceptable uses.
- H. Metal Wire-ways.
 - 1. Furnish with wire retainers on not less than 12 inch centers. All screws installed towards the inside shall be protected to prevent possible wire insulation damage.
 - 2. The finish shall be the manufacturers' standard color and shall consist of not less than two coats of enamel over a rust-inhibiting prime coat.
- I. Surface Metal Raceway (2000 series).
 - 1. Surface metal raceway shall consist of a single compartment base, blank cover, and appropriate fittings to complete the installation per the electrical drawings.

RESTROOM BUILDING

2. The base and cover shall be manufactured of steel and finished with a white color.
 3. Approximately $\frac{3}{4}$ " deep, $1\frac{1}{4}$ " high and 5' sections.
- J. Non-Metallic Multi-outlet Assemblies (5400 series).
1. Surface raceway system shall consist of a dual compartment raceway base, twin cover, appropriate fittings, outlets and device mounting plates necessary for a complete installation.
 2. Duplex receptacles and data outlets ("activate connectivity inserts") mounted at 24" centers or as noted on plans. Connect adjacent receptacles on alternate circuits.
 3. Approximately $1\frac{3}{4}$ " deep, $5\frac{1}{4}$ " high and 8' sections with equal compartments.
 4. The finish shall be white color and shall consist of not less than one coat of enamel over a prime coat.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Raceway and cable usage and installation shall conform to the appropriate article of the National Electrical Code (NEC), as a minimum.
- B. Do not install conduit that is crushed or deformed in any way.
- C. Provide a nonmetallic (nylon, polypropylene, or approved equal) drag line of suitable strength in spare conduits and telephone conduits. Tightly plug spare conduits at both ends.
- D. Do not pull wire into conduit system until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed.
- E. No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors.
- F. No wiring system of any type shall be installed in any shaft containing ducts used for vapor removal or for ventilation of commercial-type cooking equipment.
- G. Fasten and support the wiring method employed to the permanent structure using listed straps with corrosion resistant hangers and fasteners.
- H. Ceiling system wires or lay-in type ceiling grid components shall not be used as a means of support.
 1. Independent support wires and associated fittings which are installed in addition to the ceiling system support wires, shall be permitted: (300.11.A)
 2. Independent wires within the cavity of a fire-rated floor-ceiling or roof-ceiling assembly shall be distinguishable by color. (300.11.A.1)
 3. Independent support wires that provide support for device boxes shall be secured at both ends. (300.11.A).

RESTROOM BUILDING

- I. Bends shall be made with factory elbows or field bent. Field bends shall be made using equipment designed for the particular raceway material and size. Bends shall be free from dents or flattening.
- J. Conduit bodies may be used in lieu of conduit elbows where covers will be accessible and ease of installation and appearance warrants their use.
- K. Install expansion-deflection fittings where raceways cross structural expansion joints or where required to compensate for thermal expansion and contraction. Install bonding jumpers across expansion-deflection fittings in metal raceway systems.
- L. Openings through fire-resistant-rated or sound-resistant-rated walls, partitions, floors or ceilings shall be fire-stopped by installing raceways or cables through sleeves set through the walls, partitions, floors or ceilings and fire-sealing all openings and voids around the sleeves, raceways and cables.
- M. Do not drill or pierce structural steel members under any circumstances without the Engineer's specific approval.
- N. Minimize roof penetrations by routing conduit through the equipment roof opening. If roof penetration is necessary, coordinate with the Architectural Specifications and penetrate as directly below the equipment disconnect or wiring connection point as possible. Do not use flexible conduit in a pitch pan.
- O. Arrange all conduits to drain away from the building.
- P. Perform all necessary excavation and backfilling. Tamp backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. Provide shoring, bracing, and de-watering as necessary. Remove all excess and materials not suitable for backfill from the site. Provide barricades to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.
- Q. A tracer tape wire shall be installed in all trenches which do not contain conductive conductors within them. This will include future use raceways, optical fiber, etc.
- R. Raceway systems shall be complete before installing conductors.
- S. The interior of all raceways shall be cleaned before installing conductors.
- T. Terminate future use raceways with a capped coupling within an accessible area.
- U. Workmanlike manner: Type MC cable shall be installed in a neat and workmanlike manner. Cable shall not cross other cable or have excess slack. Cable that is installed vertically, must be plumb with the vertical framing of the structure.
- V. Bundling of cable is limited to three cables for each support ring.
- W. Type MC cable may be only supported by fasteners or clamps that are approved and UL tested for cable support.

3.02 INSTALLATION BELOW GRADE

- A. Minimum size raceway is 3/4 inch.

RESTROOM BUILDING

- B. Provide rigid galvanized steel conduit or PVC where conduits are installed in concrete floor slab $\frac{3}{4}$ " maximum. Maintain proper concrete coverage as directed by structural engineer. PVC conduit shall not penetrate slab above finished grade.
- C. Provide rigid galvanized steel or PVC conduit where conduits are installed below grade.
- D. Swab clean all conduits before cable installation. Waterproof all conduit joints after cable installation.
- E. Provide conduit wall sleeves for all conduits penetrating walls, grade beams, etc. and other locations shown on the Drawings.
- F. Where required to bend PVC ducts to satisfy indicated routing, preform ducts to allow ends of duct sections to be in a straight alignment. Accomplish preforming of ducts by utilizing proper duct heater units.
- G. Perform all necessary excavation and backfilling for proper installation of work. Take precautions not to excavate below depth required. Backfill trenches with sand, 3" below conduits and 3" above. Tamp remainder of backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. In areas to be paved, compact to density to receive pavement. Where pavement is broken for the installation of conduit, repair to original condition. Provide shoring, bracing, and de-watering if necessary for installation of work. Remove from site all materials encountered which are not suitable for backfill.
- H. When and if damage is caused to underground utility lines or structures, above ground utility lines or structures, or other purposeful surface conditions, either on or off the right-of-way, make immediate temporary repairs. At the first opportunity, make permanent repairs which are acceptable to the Owner. All such repairs shall be made at the Contractor's expense.
- I. Where necessary, provide barricades around open excavations to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.
- J. Where conduits embedded in concrete floor or roof deck cross expansion joints, they shall be joined together using O.Z. Gedney type DX expansion fittings and bonding jumpers. Straight runs of conduit over 150' long shall have O.Z. Gedney Type AX expansion fittings installed to minimize movement. Fittings shall be installed at a maximum of 150' on center.
- K. Where horizontal runs of conduit transition to vertical and continue above finished grade or finished floor; the transition shall be made with a 90 degree long radius sweep. The sweep may be PVC (2" and smaller) and shall be RGS (2-1/2" and larger). No PVC conduit will be allowed above finished grade or finished floor.
- L. **CONDUITS RUN BELOW FINISHED FLOOR SHALL NOT PENETRATE GRADE BEAMS. UNLESS APPROVED BY STRUCTURAL ENGINEER.**

3.03 PERMITTED RACEWAY USAGE:

- A. Raceway transitions at all locations;
 - 1. Rigid nonmetallic conduit runs from below grade level shall transition to galvanized rigid steel or intermediate steel conduit, wrapped with corrosion protection tape, prior to exiting at grade level and continue thereafter in accordance with their usage requirements.
 - a. Caulk concrete-to-conduit joints with a silicone rubber compound.

RESTROOM BUILDING

2. Continue the more protective conduit type into an area where a less protective conduit type is permitted for a distance of not less than 1 foot.
- B. Electrical metallic tubing at;
1. Interior locations when;
 - a. Concealed within walls and ceilings or; **do not use in the mortar filled cells of concrete masonry units.**
 - b. Exposed and more than 8 feet above finished floor or;
 - c. Exposed and more than 3 feet above finished floor in electrical or mechanical rooms or;
 - d. Exposed and more than 1 foot above a finished attic or mezzanine floor.
 - e. Do not use where exposed to standing water or other continuously damp or wet areas.
 2. Exterior locations when;
 - a. More than 10 feet above the finished ground surface or;
 - b. More than 1 foot above the finished ground surface within a lockable equipment yard or;
 - c. In the crawl space below a building with the 1st level elevated.
- C. Rigid or intermediate metal conduit at;
1. Interior locations when;
 - a. Exposed, in other than electrical or mechanical rooms, and installed less than 8 feet above finished floor or;
 - b. Exposed in electrical or mechanical rooms and installed less than 3 feet above finished floor or;
 - c. Exposed and less than 1 foot above a finished attic floor or mezzanine floor.
 2. Exterior locations when;
 - a. Less than 10 feet above the finished ground surface or;
 - b. Less than 1 foot above the finished ground surface within a lockable equipment yard.
 - 1) Malleable iron straps will be required at these locations.
- D. Rigid metal and intermediate metal conduit wrapped with corrosion protection tape or rigid nonmetallic conduit at;
1. Underground locations with a ¾" minimum size when;

RESTROOM BUILDING

- a. Located outside of the building line or;
 - b. Located below a concrete slab on grade or;
 - c. Located below a beam of a slab on grade or.
 - d. Located within a concrete slab on grade where the outside diameter is equal to or less than 20 percent of the slab thickness.
 - 1) Seal conduit ends at each building entry.
- 2. Below grade;
 - a. The minimum size shall be 3/4 inch.
 - b. Seal conduit ends at each building entry.
 - c. Coordinate covering with Structural Engineer.
- E. Rigid nonmetallic conduit for;
 - 1. An exposed grounding electrode or bonding conductor below 10 ft. to guard from physical damage.
- F. Flexible metal conduit in;
 - 1. Dry interior locations with a minimum length of 2 feet and maximum length of 6 feet to;
 - a. The final connection of transformers, motors and vibrating equipment.
- G. Flexible metal conduit or metal-clad cable for light fixtures or ceiling mounted devices.
 - 1. Dry or damp interior locations with a maximum length of 6 feet to;
 - a. The final connection of light fixtures; or
 - b. The final connection of ceiling mounted outlet boxes or.
- H. Flexible metal conduit is not allowed for any technology rough-in, must be EMT.
- I. Flexible metal conduit or metal-clad cable with the following limitations for receptacles and branch circuit.
 - 1. Dry interior locations;
 - 2. Feeds one outlet only;
 - 3. 20 amp maximum;
 - 4. Both segment ends are located within the same room.
 - a. One segment end at the outlet box and the other segment end at a ceiling junction box located, within 10 feet of the entrance into the wall cavity, vertically above the outlet served.

RESTROOM BUILDING

5. Where installed in an insulated wall, the cable must be on the conditioned side of the insulation and;
 6. Each cable or conduit shall be supplied by only one (1) branch circuit breaker (one, two or three poles).
 7. No MC to be horizontal in wall. All horizontal runs must be pipe and wire only.
- J. Liquid-tight flexible metal conduit in;
1. All locations with a minimum length of 2 feet and maximum length of 6 feet for;
 - a. The final connection of all liquid pump motors and associated control connections or;
 2. Damp or wet interior and all exterior locations with a minimum length of 2 feet and maximum length of 6 feet to;
 - a. The final connection of transformers, motors, and vibrating equipment.

END OF SECTION

SECTION 26 05 34 - OUTLET BOXES, PULL BOXES AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide outlet boxes in accordance with the National Electrical Code at locations shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide standard hot-dipped galvanized pressed steel boxes, minimum 4"x4" by 1-1/2" deep. Use 4 11/16" by 2 1/8" deep box when using 1" conduit.**
- B. Cabinets with screw covers or as specifically noted for junction or pull boxes larger than 150 cubic inches.
- C. All junction, pull and splice boxes to conform to NEC Article 370.
- D. All metallic boxes are to have an internal means of grounding.
- E. Flush mounted wall and finished ceiling boxes.
 - 1. Within framed, drywall, plastered or tile covered walls, with 3/4" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover and a far-side support.
 - 2. Within drywall or plaster covered or suspended ceilings, with 3/4" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover.
 - 3. Within masonry walls, with 3/4" max. raceway, furnish galvanized steel boxes, minimum 2-1/2-inch deep.
- F. Surface mounted boxes.
 - 1. Mounted at or below 10' above the finished surface, 3/4" max. raceway size, furnish cast aluminum boxes with a surface mounted cover.
- G. Junction and Pullboxes.
 - 1. Furnish, minimum 4" square, 1 – 1/2" deep, galvanized steel junction and pullboxes where installation conditions warrants their use. Boxes shall be furnished with screw-on covers or hinged covers. Covers shall be such that it can easily be handled by one person. All hardware and fasteners shall be galvanized steel.
- H. Flush mounted floor boxes.
 - 1. Furnish adjustable, concrete tight, corrosion resistant, duplex type. Compartmental type for combination receptacle and communication. The coverplate shall be brass with hinged flap and carpet flanges. The minimum below ground/slab conduit size shall be 3/4".

RESTROOM BUILDING

- I. Underground boxes.
 - 1. U. L. listed.
 - 2. Pre-cast, polymer concrete.
 - 3. Minimum size of 10" W X 10" L X 10" H.
 - 4. Bolt down cover.
 - 5. Stainless steel hex-bolts and replaceable nuts.
 - 6. Minimum load rating of 5,000 lbs. (select by location)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Through wall boxes and boxes mounted back-to-back are not permitted. Provide 8 inch minimum separation in order to minimize sound transmission.
- B. Set flush with wall or ceiling finish in accordance with N.E.C., Article 370. Extension sleeves are not permitted for boxes improperly set.
- C. Verify location of outlets prior to rough-in. When necessary, relocate outlets to avoid interference with other work or equipment. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers.
- D. Where more than one (1) switch or device is located at one (1) point, unless otherwise indicated, provide gang boxes and covers. When the voltage between switches exceeds 300 volts, provide barrier partitions between adjacent switches located in the same box. Sectional switch boxes or utility boxes not permitted.
- E. Provide pressed steel boxes for all interior work. Provide square boxes with plaster rings. Provide appropriate size multi gang box for group devices. Single gang boxes screwed together is not acceptable.
- F. Where boxes are installed in masonry walls, use only approved masonry type boxes for single gang and multi-ganged applications. Standard 4" square boxes with plaster rings are not allowed. Caulk around joint between receptacle box and masonry. Verify color with architect.
- G. Do not drill and pierce structural concrete members and structural steel without prior approval of the Engineer.
- H. Mount all boxes plumb.
- I. Mount boxes completely rigid without conduit or finished wall support.
- J. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging, and/or straps as required to make the outlet completely rigid. Support boxes with "caddy screw gun brackets", "caddy box mounting bracket", "caddy quick mount box brackets" or acceptable alternates.

RESTROOM BUILDING

- K. **Dimensions are from finished floor to centerline of outlets.** Adjust heights of outlets in masonry walls from that indicated so that receptacles are not lower than 16" A.F.F. and switches are not higher than 48" A.F.F. Outlet height so adjusted shall be consistent. Unless otherwise indicated, mount outlets at the following heights:

Wall switches/Wall Phone	4 ft. - 0 in.
General Duplex receptacles	1 ft. - 6 in.
Receptacles at Millwork	verify with millwork
Receptacle for Refrigerators	2' – 6"
Weatherproof duplex receptacles	1 ft. - 6 in.
Telephone/Data outlets/Teacher Station	1 ft. - 6 in.
Telephone/Data at millwork	verify with millwork
Garages/Apparatus Bay receptacles	2 ft. - 0 in.
Clocks	8 ft – 0 in
Access Point Data Drops (wall mounted)	10 ft – 0 in

- L. For boxes installed above ceilings, label the box cover with the circuit numbers installed. Labeling shall be with a permanent, black marker with broad tip.
- M. Boxes installed in rated walls shall have a minimum horizontal separation of 24". Maximum surface area of boxes shall not exceed 16 square inches.
- N. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required for bottom covering. Adjust covers flush with finished floor.
- O. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall.
- P. Install recessed boxes flush to the finished wall or ceiling line by the use of manufactured tile rings to extend the box forward.
- Q. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.
- R. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture.
- S. Install knockout closures to cap all unused openings.
- T. All boxes shall be installed with coverplates.
- U. Install boxes as required to facilitate conductor installation in raceway systems. Junction and pull boxes shall be sized to accommodate conductors, splices, devices and fittings.

RESTROOM BUILDING

- V. Raceways are NOT allowed to terminate to extension rings.
- W. Install boxes so that covers are accessible and easily removable after completion of the installation. The minimum clear space in the direction of the box opening shall be 36".
- X. Include suitable access doors, with the proper fire rating, for boxes above inaccessible ceilings. Boxes shall be located within reach of the access.
- Y. Install underground boxes with cover slightly above finished grade.
- Z. **Spray paint J-Boxes red for Fire Alarm Systems. All other special system J-Boxes to be painted white.**

END OF SECTION

SECTION 26 05 80 - EMPTY RACEWAY ROUGH-IN

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install all equipment, accessories and material required for the rough-in of empty raceway systems in accordance with the specifications and drawings.
- B. Rough-in raceway sections for indicated devices and outlets in all walls, floors and underground sufficient to facilitate installation of the following systems without cutting or otherwise damaging walls, ceilings or floors installed in this contract:
 - 1. Communications
 - 2. Fire Alarm
 - 3. Television
 - 4. Data
 - 5. Security
 - 6. Controls
- C. **ALL CONDUITS SHALL HAVE A PULL CORD INSTALLED. INSTALL BLANK COVERS ON ALL UNUSED JUNCTION BOXES.**
- D. 3/4" CONDUIT MINIMUM.
- E. Electrical Contractor shall provide all conduit, junction boxes and outlet boxes for HVAC controls as specified in Section 26 05 00, 1.03, D. Coordinate locations and requirements with Mechanical Contractor and Controls Contractor prior to rough-in. Provide outlet box for sensor and conduit to above accessible ceiling. Provide conduit for all wiring in areas with no ceiling. Provide conduit from outdoor units to above accessible ceilings. Provide conduit between make-up air units and associated condensing units.
- F. **REFERENCE TECHNOLOGY DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS CONCERNING CONDUIT ROUGH-IN FOR VOICE/DATA SYSTEMS.**
- G. Floor mounted devices: Provide pathway to nearest accessible ceiling for all floor mounted devices called for in this specification.

1.02 QUALITY ASSURANCE

- A. Construct each item of equipment, including parts and accessories, in a workmanlike manner, using new materials or the best quality obtainable for the purpose intended. Design and build materials in accordance with the best practices of the electrical industry.
- B. Comply with all requirements of serving utility.

PART 2 - EXECUTION

2.01 INSTALLATION

- A. Interior conduit systems shall have runs less than 100 feet from point to point.
- B. Provide accessible pull boxes when necessary. Provide blank covers for all outlet boxes, unless otherwise noted.
- C. All bends for telephone and cable television service shall be 36 inch radius, minimum.
- D. Provide outlet box in wall at 18" A.F.F. (UON) and conduit with string to above accessible ceiling location. Provide insulated bushing on end of conduits.
- E. **Provide one (1) additional outlet boxes and conduit with pull cord to above the ceiling. Final location shall be as directed by the Architect. Outlets can be added at any phase of construction with the exception of finished CMU walls.**

END OF SECTION

SECTION 26 24 16 - BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide branch circuit panelboards as shown on the Drawings and as herein specified.
- B. Panelboard feeders are sized from the "Panelboard Connection Schedule". When a panel is fed from a transformer use the "Transformer Connection Schedule" for feeder size. When there is a conflict between the sizes, use the largest of the two.
- C. This section specifies the furnishing and installation of molded case, thermal-magnetic circuit breakers. Electronic, solid-state trip circuit breakers are NOT allowed.
- D. Maximum circuits per panelboard section shall be 42 circuits.

1.02 STANDARDS

- A. Provide U.L. label.
- B. Comply with applicable standards of NEMA and the NEC.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D/Schneider Electric
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse/Eaton
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for each branch circuit panelboard.
- B. Submit shop drawings for each panelboard which include outline and support points, dimensions, voltage, main bus ampacity, short circuit ampere interrupting rating, circuit breaker arrangement, sizes and number of poles. Shop drawing shall list all spaces and circuit breakers to be installed in each panelboard.
- C. Provide shop submittal which includes the following:
 - 1. Cabinet
 - a. Housing
 - b. Trim
 - c. Outline dimensions
 - d. Available spaces
 - e. Panelboard mounting

RESTROOM BUILDING

2. Circuit breakers
 - a. Frame size
 - b. Trip setting
 - c. Class
 - d. Interrupting rating in RMS Symmetrical amperes
 - e. Mounting
 - f. Voltage rating
 3. Busing
 - a. Ampere rating
 - b. Material
 - c. Incoming cable lug size
 - d. Bus bracing
 4. Manufacturer's catalog numbers.
 5. Other descriptive data as may be required.
- D. Circuit breaker arrangement must be identical to the schedules or one line diagram unless there is a technical reason for deviation. All reasons for deviation must be stated on the shop drawings.**
- E. Unless specifically noted, only Max 42 circuits per section will be allowed.**

PART 2 - PRODUCTS

2.01 GENERAL.

- A. All new panelboards and switchboards on this project shall be by the same manufacture. The manufacture shall be the same as the manufacturer of the circuit breakers.
- B. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trims shall have pre-formed covers for unused mounting space.
- C. Interior leveling provisions shall be provided for flush mounted applications.
- D. Panelboards shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- F. Furnish suitable lugs for each conductor requiring a connection.

RESTROOM BUILDING

2.02 BUS CONSTRUCTION

- A. Fabricate all buses of 98 percent IACS conductivity, copper. Size buses to limit their temperature rise within the panelboard to 65°C based on a 40°C ambient temperature.
- B. Provide one continuous, un-reduced in size, bus bar per phase with “distributed phase” or “phase sequence” type connections to the branch circuit breakers. Extend the buses the height of the panelboard.
- C. Provide circuit breaker connections to the bus by means of a bolt. Square D “I-Line” may be provided.
- D. Insulate each individual phase bus to withstand 2000 volts a-c for 1 minute.
- E. Support the bus systems using non-carbonizing, non-tracking insulators.
- F. Furnish fully equipped spaces, include all appropriate connectors or mounting hardware.
- G. Furnish an insulated neutral bus which is the same size as the phase buses. Larger sizes may be required by the schedules or one line diagram.
- H. Furnish a solidly bonded equipment ground bus. Include terminals for feeder and branch circuit grounding conductors.
- I. Furnish an isolated ground bus, with terminals, where scheduled or noted on the drawings.
- J. Provide full size or larger insulated neutral bus bar. Where specified on the panel schedule, provide 200% rated neutral bus bar. Coordinate with plans.

2.03 RATINGS

- A. Panelboards and circuit breakers shall be rated for 60 hertz and have a voltage and current rating as indicated on the drawings or schedules.
- B. The finished panelboard assembly shall be fully rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault currents indicated on the drawings or schedules. The minimum rating for a 240 volt a-c panelboard shall be rated 10,000 AIC RMS symmetrical and a 480 volt a-c panelboard shall be rated 14,000 AIC RMS symmetrical minimum. Series ratings are not permitted.
- C. **Final AIC ratings for all panels shall be determined and provided by the gear manufacturer to meet minimum allowable fault current from utility company transformer. Provide coordination study and fault current analysis as required for justification of sizes. Make all changes required by coordination study and include in bid price. Coordination study must be completed prior to submitting gear.**

2.04 ENCLOSURES

- A. Enclosures shall be at least 20 inches wide and made from galvanized steel with welded interior mounting studs. Provide gutter space in accordance with the National Electrical Code. Where conductors are carried through a box, the box shall be sized to include the additional space. Enclosures shall be fully enclosed.
- B. **ALL MULTI-SECTION PANEL ENCLOSURES SHALL BE THE SAME HEIGHT.**

RESTROOM BUILDING

2.05 HINGED FRONT COVER

- A. Mounting shall be flush or surface as indicated on associated schedules or drawings. Surface trims shall be the same height and width as the box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
- B. Fronts shall be of the concealed hinged type. Front shall not be removable with the door closed.
- C. Doors on front shall have rounded corners; edges shall be free of burrs. Doors shall have a flat latch type lock with a catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One key shall be provided with each lock.
- D. Furnish a nameplate, circuit directory frame, card and a clear plastic covering on the inside of the door. All loads shall be identified as specified in Section 16075.

2.06 FINISH

- A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray paint applied.
- B. Nema 3R enclosures shall be properly cleaned, primed, and a finish coat of gray paint applied.
- C. Supply one quart of finish paint for each project. Touch-up after installation.

2.07 MOLDED CASE THERMAL-MAGNETIC CIRCUIT BREAKERS

- A. Furnish molded case, thermal-magnetic circuit breakers in lighting / appliance and power distribution panelboards for the specified service with the number of poles and ampere ratings indicated on the schedule or drawings. Incorporate inverse time characteristic by bi-metallic overload elements and an instantaneous characteristic by magnetic trip.
- B. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
- D. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breakers shall be clearly marked ON and OFF.
- E. Circuit breakers shall be factory sealed.
- F. All circuit breakers shall be suitable for mounting in any position.
- G. Circuit breakers shall be equipped with factory installed mechanical lugs.
- H. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- I. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

RESTROOM BUILDING

- J. For 2-pole and 3-pole breakers, use the common-trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable except where multiple single breakers are used to serve modular furniture.
- K. Where indicated, provide ground fault (GFCB) or shunt trip breakers.

2.08 LISTING

- A. The completed panelboard shall be UL listed.
- B. Certification standards, with applicable voltage systems and corresponding interrupting ratings, shall be clearly marked on the face of each circuit breaker.
- C. Circuit breakers shall be equipped with listed electrical accessories as noted on the schedules or drawing.
- D. When required, circuit breakers shall be listed as HACR type.
- E. When required, circuit breakers shall be listed as Switch Duty type.
- F. When required or indicated on the drawings or schedules, equipment shall be listed for the environment in which it is installed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install box, trim and interior rigid and plumb. Center interior with opening.
- B. Install panelboards in accordance with the instructions of the manufacturer and as shown on the Drawing. Install complete with all required electrical connections.
- C. Unless otherwise noted, install panelboards with the top of the trim 6 ft. 0 in. above finished floor.
- D. Field check panelboard loading and reconnect circuits as required to provide balanced phase and line loads.
- E. Neatly bundle, route and support cables installed in wiring gutters of panelboards. Minimum bending radii as recommended by the wire and cable manufacturer.
- F. Install five (5) 3/4" conduits from top of flush mounted panelboards to accessible void above ceiling. Cap end of conduits above ceiling.
- G. All recessed panels are to be installed in 6" minimum wall thickness. Coordinate clear dimensions with Architect and General Contractor prior to rough-in.
- H. Provide wood trim for any semi-recessed panels, including panelboards. Coordinate with General Contractor and verify finishes with the Owner/Architect.
- I. Install filler blanks for any unused breaker space.
- J. All panel interior to be free of debris and dirt prior to installing panel covers.
- K. Check bolted and circuit breaker connections using a torque wrench.

RESTROOM BUILDING

- L. The faces of all circuit breakers shall be flush with each other.
- M. Affix permanent and individual circuit numbers to each circuit breaker in a uniform position.

END OF SECTION

SECTION 26 27 26 - DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide switches and receptacles as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

- A. Provide all receptacles which conform with NEMA standards for amperage and voltage classification.
- B. Provide devices U.L. listed for the application and for the type of wire used.

1.03 ACCEPTABLE MANUFACTURERS

- A. Leviton, or approved equal

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for each device.
- B. Provide shop submittals which include the following information:
 - 1. Manufacturer and catalog number.
 - 2. NEMA configuration.
 - 3. Voltage and amperage ratings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Straight Blade Receptacles: Furnish Leviton receptacles or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
 - 1. Single receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 - 2. Single receptacle, 20 amp, 250-volt, 2-pole, 3-wire, grounding, NEMA 6-20R.
 - 3. Duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 - 4. Tamper resistant, duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
- B. Toggle Switches: Furnish Leviton switches or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
 - 1. Single pole, single throw, 20 amp, 120/277 volt.
 - 2. Single pole, double throw, momentary, 20 amp, 120/277 volt.

RESTROOM BUILDING

3. Single pole, double throw, maintained, 20 amp, 120/277 volt.
 4. Double pole, single throw, 20 amp, 120/277 volt.
 5. Three way, single throw, 20 amp, 120/277 volt.
 6. Four way, single throw, 20 amp, 120/277 volt.
- C. Locking Switches: Furnish Leviton switches with #55500 key, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
1. Single pole, single throw, 20 amp, 120/277 volt.
 2. Single pole, double throw, momentary, 20 amp, 120/277 volt.
 3. Single pole, double throw, maintained, 20 amp, 120/277 volt.
 4. Double pole, single throw, 20 amp, 120/277 volt.
 5. Three way, single throw, 20 amp, 120/277 volt.
 6. Four way, single throw, 20 amp, 120/277 volt.
- D. Dimmer Switches: Furnish Lutron NT series, or equivalent, continuously adjustable slide dimmer with preset on/off switch. Dimmer shall be solid-state type for use with 120-volt incandescent lamps and shall have electromagnetic filters to eliminate noise, RF and TV interference. Dimmer wattage is indicated on the drawings or 1000 watt minimum.
- E. Ground Fault Devices: Color shall be White. (Devices and coverplates connected to emergency circuits shall be red).
1. Ground fault circuit interrupter (GFCI), 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.
 2. Ground fault feed through switch, 20 amp, 125-volt.
- F. Device Plates:
1. Unless otherwise indicated, provide smooth metal device plates of Type 430 stainless steel for all indoor devices. Verify color with architect prior to ordering. Cover plates for devices served by emergency circuits shall be red.
 2. Provide telephone and data outlets with blank metal type 430 stainless steel covers.
 3. Provide properly gasketed vertical single lift device plate of aluminum die cast for weatherproof receptacles and/or switches.
- G. Floor Outlets:
1. Provide where shown on the drawings, PVC rectangular floor boxes. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.
 2. Receptacle floor outlets specified as duplex shall have duplex screw cap coverplates. Telephone and/or data floor outlet boxes to have combination screw cap coverplate.

RESTROOM BUILDING

- 3. Provide brass carpet flanges for each floor box installed in carpeted areas.
- 4. Multiple device locations shall incorporate two (2) or three (3) gang outlet box.
- H. Provide GFI receptacles within 6 feet of any sink, lavatory, wet area and outdoors. All GFI resets to be located in the same room protected.
- I. Provide GFI protection for all receptacles in areas where power hand tools or portable lights are used (shop areas, garages, etc.).
- J. Provide GFI protection for all circuits used for heat tracing.
- K. Provide a receptacle in all mechanical/electrical rooms.
- L. Surge Arresting Receptacles: Where surge arresting receptacles are indicated, provide receptacles meeting Federal Specification WC-596F which are UL listed (UL 1449 and UL 498) with integral surge suppression. Provide with audible surge protection failure alarm and replaceable surge arrester module. Eagle Electric "Super Spec SurgeBloc" or acceptable equal.
- M. All 120volt/20amp receptacles in kitchen area to be GFCI protected.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wiring devices of the type as indicated on drawings. Make up all connections tight and set device plumb. Use care in installing device in order to prevent damage to the device and the wire in the outlet box.
- B. Device Plates: Provide a device plate for each outlet to suit the device installed and install blank plates or covers for junction boxes and empty outlets, including telephone, computer, etc.
- C. Mount duplex receptacles vertically with grounding opening up unless otherwise noted.
- D. Prior to installation of outlets other than 20A, 120 Volts, verify receptacle type with Owner through Architect. Receptacles not verified shall be changed at Electrical Contractor's expense if necessary to operate equipment.
- E. Install all switches that are required to be handicap accessible at proper height per latest ADA Standards.
- F. Install wall switches vertically in an outlet box on the strike side of the door as finally hung.
- G. Install single throw switches so up is the ON position.
- H. Locking switches shall be furnished in corridors, common areas and any area with HID lighting. Contractor shall confirm exact location of all locking switches with the Architect/Engineer prior to rough-in.
- I. Provide "Caddy Screw Gun Bracket" between wall studs, as required to install switches, thermostats, intercom devices, etc. Verify exact location of devices prior to rough-in. Device boxes shall be aligned on center line of each box.

RESTROOM BUILDING

- J. Receptacles installed for electric water coolers shall be mounted at a height so as not to be visible after installation of EWC. Coordinate with equipment being provided.
- K. Provide one (1) duplex GFI/weatherproof receptacle within 25 feet of all mechanical equipment, located on the roof, on mezzanines, or on the ground. Connect receptacles to nearest available circuit with not more than 6 receptacles or home run to the nearest available panelboard and provide breaker as required.
- L. Engrave coverplates, designated for engraving, with 1/8 inch-high contrasting lettering.
- M. Engrave the coverplates of wall switches that control equipment which is not in sight of the switch with the designation of the equipment being controlled. Lettering shall be 1/8 inch high and of a contrasting color.
- N. All receptacles located above counter tops with sinks and receptacles in kitchens shall be GFI Type.
- O. Provide two (2) additional receptacles in base bid including wire, conduit, breakers and appurtenances. Each receptacle represents a dedicated circuit. Estimate length of circuit is 150 feet. Final location as directed by Architect.**
- P. Provide unit price to add additional receptacles over base bid. Use same lengths indicated above.**

END OF SECTION

SECTION 26 28 10 - MANUAL MOTOR STARTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide and install manual motor starters per NEC and as hereinafter specified.

1.02 STANDARD

- A. UL Listed.
- B. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. Cutler Hammer/Westinghouse
- C. ITE Siemens
- D. General Electric

1.04 SUBMITTALS

- A. Provide data sheets that include equipment voltage/current rating, catalog numbers, horsepower rating and other such descriptive data which may be required.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

- A. All manual motor starter switches shall consist of toggle operated two (2) or three (3) pole switches mounted in a NEMA 1 general purpose enclosure unless exposed to outdoor conditions; then mount in NEMA 3R enclosure.
- B. Contacts shall be double break silver alloy.
- C. Terminals shall be supplied, clearly marked and accessible from front of switch.
- D. Switch shall be equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and inter-changeable. Starter shall be inoperative if thermal unit is removed.
- E. Toggle switch shall be furnished with a handle guard.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount switches in accordance with NEC and all local codes. Provide all mounting materials and hardware.

RESTROOM BUILDING

- B. Confirm with Mechanical and/or Plumbing Contractor prior to mounting switch on respective equipment.

END OF SECTION

SECTION 26 28 15 - SAFETY DISCONNECT SWITCH

PART 1 - GENERAL

1.01 SCOPE OR WORK

- A. Provide safety switches for all pieces of equipment per NEC as indicated on the Drawings and specifications or as required.
- B. All safety switches are to be FUSED unless noted otherwise.**

1.02 STANDARDS

- A. Conform to U.L. listed and the latest NEMA standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittal for safety disconnect switches.
- B. Provide shop submittals which include the following information:
 - 1. NEMA type
 - 2. Enclosure type
 - 3. Ampere rating

PART 2 - PRODUCTS

2.01 CONSTRUCTION

- A. Provide safety switches appropriately rated for use with electrical system 600 Vac for 480 volts, 250 Vac for 208 volts and etc.
- B. Provide safety switches NEMA Standard KS1 for type HD (heavy duty), and horsepower rated for A/C motors.
- C. Switches requiring fuses and rated 600 amps and below shall be provided with rejection clips. Switches rated larger than 600 amps shall have Class "L" fuse connections provided.
- D. Provide safety switches in NEMA 1 enclosure located on the interior dry locations. Provide safety switches in NEMA 3R enclosure located on the exterior of the building or in wet locations.

RESTROOM BUILDING

- E. Provide quick-make and quick-break operating handle. Provide mechanisms which are an integral part of the box. Furnish a handle suitable for padlocking in the ON and OFF positions with a padlock of 5/16-inch diameter shank.
- F. Door Interlock. Furnish a door interlock to prevent opening the door when the switch is in the ON position, unless bypassed, and to prevent turning the switch ON when the door is open.
- G. Bypass Interlock. Furnish an external means to bypass the door interlock.
- H. Terminal Shield. Furnish incoming line terminals with an insulated shield so that live parts are not exposed when the door is open.
- I. Neutral. Where neutrals are indicated furnish switches with an isolated, fully rated neutral block. Make provisions for bonding the block to switch enclosure.
- J. Equipment Grounding. Furnish an equipment grounding kit.
- K. Fuse Holders. Where fusible switches are indicated, furnish switches with rejection-type fuse holders and fuses conforming to Section 16490, Fuses - 600 Volt and Below.
- L. Auxiliary Contacts. Where switches are shown for elevator service, furnish switches with two DPST auxiliary contacts.
- M. Provide lugs U.L. listed for copper cable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount safety switches in accordance with the N.E.C. Provide all mounting materials and mount safety switches vertically.
- B. In general, safety switches must be mounted on an independent and separate support system, not on the equipment being served. Where such an independent support would require penetrating or resting on a roof, it is preferable to mount on the equipment. In no case, however, may the switch interfere with access to or operation of the equipment, nor shall the switch be located within the significant impact zone of a flue or other high temperature component. Where screen walls are provided for outdoor units; the top of disconnect shall be below or equal to the top of screen wall.
- C. Coordinate final location of disconnect switches to provide a minimum of 36" clear in front of switch. Conduit may not be routed in access clear directly in front of disconnect switch.
- D. Install switches for all equipment that requires them. Mount so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.
- E. Disconnects mounted above ceiling must be mounted to be readily accessible near unit. Handle to be no more than 36" above ceiling grid.
- F. All exterior disconnects to be mounted below line of sight of a screen wall or if single disconnects, level with top of condenser. Verify location with Architect/Engineer prior to rough-in.

END OF SECTION

SECTION 26 28 16 - FUSES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide and install fuses as shown on the Drawings and as hereinafter specified.

1.02 STANDARDS

- A. Conform with the latest requirements of the National Electrical Code, NEMA and be UL listed.

1.03 ACCEPTABLE MANUFACTURERS

- A. Bussman
- B. Gould
- C. Little Fuse

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Time Delay/Dual Element (Class R) fuses 1/10 through 600 amps.
- B. Time Delay/Dual Element (Class RK5) fuses 1/10 through 200 amps for mechanical equipment and where noted.
- C. Time Delay (Class L) fuses 601 - 6000 amps.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Fuses shall not be installed until equipment is ready to be energized.
- B. Test and inspection shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening and review of all electrical connections and inspection of all grounding conductors.
- C. All fuses shall be furnished and installed by the Electrical Contractor.
- D. All fuses shall be of the same manufacturer.
- E. **Equipment Fuses: Verify final fuse size with actual equipment being installed. Do not exceed permitted fuse size and voltage of manufacturer ratings.**

RESTROOM BUILDING

3.02 INSTALLATION

A. Mains, Feeders and Branch Circuits:

1. Circuit 0 to 600 amperes shall be protected by current limiting dual-element, time delay fuses. All dual-element fuses shall have separate overload and short-circuit elements. The fuse must hold 500% of rated current for a minimum of ten (10) seconds, with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted). They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.
2. Circuits 601 to 6000 amperes shall be protected by current limiting time delay fuses. Fuse link shall be pure silver links (99.9% pure), to limit the short circuit current let through valves to low levels and comply with NEC Sections requiring component protection. Fuses shall be time-delay and must hold 500% of rated current for a minimum of four (4) seconds with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L. "CAUTION" labels to alert the end user of engineered level of protection of the electrical equipment, shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.
3. Motor Circuits - All individual motors rated for 200 horsepower or less shall be protected by time delay/dual-element fuses. The fuses for motors shall be installed in ratings approximately 125% of motor full load current, except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to a full speed quickly, such as large fans. Motors shall be protected by fuses of the rating shown on the Drawings. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted) Dual Element/Time Delay. "CAUTION" labels to alert the end user of the engineered level of protection of the electrical equipment shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

B. Spares:

1. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in cabinet as identified in Specification Section 26 05 00.

END OF SECTION

SECTION 26 28 25 - CONTACTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide lighting contactors as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

- A. Approved per UL 508 and designed in accordance with NFPA 1C52-211B.
- B. UL listed.
- C. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. ITE Siemens
- C. Cutler Hammer/Westinghouse
- D. General Electric

1.04 SUBMITTALS

- A. Furnish Engineer shop submittals for contactors.
- B. Provide shop submittal which includes the following information:
 - 1. Voltage and ampere rating
 - 2. Wiring diagram
 - 3. Enclosure type
 - 4. Coil voltage

PART 2 - PRODUCTS

2.01 GENERAL

- A. Continuously current rated.
- B. Capable of making and breaking all cases of loads without the aid of auxiliary arcing contacts. Auxiliary arcing contacts are not acceptable.
- C. Industrial duty rated for applications to 600 volts maximum.

RESTROOM BUILDING

2.02 MATERIALS

- A. Totally closed, double break, silver to silver power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
- B. Provide terminals with straight through wiring and accept copper wire.
- C. Provide switches or provisions for switches as indicated on the drawings.
- D. Unless otherwise indicated, provide contactor in NEMA Type 1 enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely mount lighting contactor. Provide all mounting hardware.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown.

1.02 STANDARD

- A. Provide all materials and accessories, whether specifically described or not, of the best grade of the commercial manufacturer. Provide first class workmanship in every respect.
- B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures is not acceptable.
- C. Manufacture all lighting fixtures in accordance with the National Electrical Code.
- D. Ballasts:
 - 1. Provide ballasts for fluorescent lamps which meet U.L. specifications for Class P listing, applicable ANSI Standard Ballast Specifications, and certified by C.B.M.
Maximum - 2 lamps per ballast.
 - 2. Provide ballasts for HID lamps which comply with the UL Standard for High-Intensity Discharge Lamp Ballasts.
- E. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania. (3500K)

1.03 ACCEPTABLE LIGHTING PACKAGES:

- A. Lithonia
- B. Thomas Daybrite
- C. Hubbell
- D. Others Fixtures as Scheduled or Noted

1.04 SUBMITTALS

- A. Furnish Engineer shop drawings for each fixture.
- B. Provide shop drawing which includes the following information:
 - 1. Fixture type per the fixture schedule.
 - 2. Manufacturer of the fixture.
 - 3. Physical dimensions of the fixture.
 - 4. Manufacturer's standard finish.

RESTROOM BUILDING

5. Fixture output distribution curves with utilization parameters.
 6. Ballast temperature rating, voltage, wattage, and manufacturer.
 7. Material type and thickness of lens.
 8. Accessories for installation such as swivel hangers.
 9. Number and type of lamps.
- C. Submit point-by-point lighting calculations for areas as required by the specifications or noted on the drawings. The calculations shall include lamp lumen depreciation, luminaire dirt depreciation, ballast factor, lamp tilt factors, and initial lamp lumens. The calculations shall indicate maintained horizontal footcandle levels at a height of thirty inches above the floor. In interior spaces the maximum point spacing shall be five feet on center; for outdoor applications the maximum point spacing shall be 30 feet on center unless otherwise noted on the drawings.
- D. Lighting Control Submittal
- Shop Drawing Floorplan drawings at 1/8" scale showing
 - motion sensor layout as directed on plans
 - daylight sensor layout as directed on plans
 - identify enabled fixtures
 - identify power packs
 - identify power pack location for open ceiling areas (above panel in electrical room)
 - symbol legend identifying symbols
 - control sequences
 - riser diagrams showing low voltage cabling requirements
 - cutsheets all parts

1.05 PRODUCTS STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

1.06 COORDINATION

- A. Catalog numbers shown on the light fixture schedule may not include or adequately represent all the options and accessories required herein, this contractor shall conform to these specifications in there entirety.
- B. The various ceiling types are indicated on the architectural plans and in the room finish schedules. All lighting fixtures shall be coordinated with the architectural requirements to insure that the proper trim kit, and/or mounting accessory is provided with each fixture for the intended application. All trim kits and accessories shall be provided by Contractor whether or not they are specifically indicated by the manufacturer's catalog numbers on the lighting fixture schedule.
- C. The locations of all lighting fixtures are approximate. Locations are subject to modifications at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide all fixtures as called for in the schedules complete with lamps.
- B. Provide manufacturer's standard finish unless otherwise noted.
- C. Design all recessed or semi-recessed fixtures compatible with ceilings as installed. Provide frames where required for proper installation.
- D. Furnish complete, all fixtures requiring end caps, mounting spacers or other necessary items whether the catalog number shown includes such items or not.
- E. Conceal all fixture parts within the fixture construction.
- F. **Self locking lenses/latches are not acceptable.**
- G. Lighting fixture construction shall effectively eliminate light leaks between the frame, lens, housing and the interior finish surface. Furnish one lens hold-down clip at two foot centers.
- H. Linear fluorescent lampholders shall be turn type, medium base, bi-pin, 660 watt, 600 volt.
- I. Conceal all fixture parts, including emergency components, within the fixture construction.
- J. Fixture construction shall allow parts and lens to be replaced without special tooling.
- K. Fixture shall be provided with disconnecting means per NEC 2008.

2.02 FLUORESCENT LIGHTING FIXTURES

- A. Grid troffers (lay-ins) must conform to the following:
 - 1. Steel housing with T-bar clips.
 - 2. Flush steel door frame with metal rotary action latches. Door latches or hinges from either side.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern a with minimum thickness of 0.095 inches.
- B. Wet location troffers must conform to the following:
 - 1. Steel housing.
 - 2. Flush aluminum door frame with metal rotary action latches.
 - a. Door latches or hinges from either side.
 - b. Neoprene gasketing between the lens, doorframe, housing and mounting surface.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with internal prisms and a minimum thickness of 0.125 inches.

RESTROOM BUILDING

- C. Surface or stem mounted fixtures with a lens must conform to the following:
 - 1. Steel housing.
 - 2. Flush steel door frame with metal rotary action latches.
 - 3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with a minimum thickness of 0.095 inches.
- D. Strip lights must conform to the following:
 - 1. Steel, heavy duty construction.
 - 2. 4 foot lamp lengths. Tandem, double length units are acceptable.
 - 3. Lampholder are secured by a screwed-on end plate.
 - 4. 4 foot wireguards. Tandem units require 2.

2.03 COMPACT FLUORESCENT LIGHTING FIXTURES

- A. Compact fluorescent downlights must conform to the following:
 - 1. Galvanized steel frame with adjustable hangers.
 - 2. Outdoor and wet area fixtures shall be lensed, gasketed and listed for wet locations. Only lenses which are flat shall be provided.
 - 3. Electronic ballast if available.

2.04 FLUORESCENT BALLAST

- A. Ballast which are located outdoors and in un-heated indoor areas shall be rated for reliable starting to 0 degree F.
- B. All fluorescent ballasts must conform to the following:
 - 1. Thermally protected Class P with auto restart circuitry.
 - 2. Class "A" sound rating.
 - 3. Power factor equal to or greater than 90.
 - 4. Contain no PCBs or asbestos.
 - 5. Certification Ballast Manufacturers (CBM) approved.
 - 6. Provide Quick Disconnect (QD) option for quick disconnecting of all ballasts.
- C. Linear fluorescent ballast must conform to the following:
 - 1. Fixtures with three or more lamps shall have two ballast to accommodate dual level switching. Provide 1 or 2 lamp ballasts. Do not use 3 and 4 lamp ballasts. All ballast are to be installed within the fixture of the lamps served.
 - 2. Electronic, instant-start and parallel-connected.

RESTROOM BUILDING

3. Enclosed in a metal enclosure.
 4. Provided with integral, color coded leads.
 5. Operate at a frequency of 20kHz or greater with less than 3 % visible lamp flicker.
 6. Input current total harmonic distortion (THD) shall not exceed 10%.
 7. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.
 8. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts.
 9. Provide transient immunity.
 10. Allow remaining lamp(s) to maintain full light output if one or more lamps fail.
 11. Tolerate sustained open circuit and short circuit output conditions without damage.
 12. Tolerate operation of up to 65 deg. C. case temperature without damage.
 13. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).
- D. Compact fluorescent ballast must conform to the following:
1. Operate at a frequency of 20kHz or greater with less than 3 % visible lamp flicker.
 2. Input current total harmonic distortion (THD) shall not exceed 20%.
 3. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.
 4. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts.
 5. Provide transient immunity.
 6. Tolerate sustained open circuit and short circuit output conditions without damage.
 7. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).

2.05 FLUORESCENT POWER PACKS

- A. Where indicated, furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.
- B. Fluorescent power packs must conform to the following:
1. Suitable for use in both normal and emergency operational modes.
 2. Compatible with magnetic and electronic, instant start, 4 foot T8 lamps.

RESTROOM BUILDING

3. Produce 1000 to 1400 lumens initial emergency light output.
 4. Operate one lamp in each fixture for a minimum of 90 minutes.
 5. Steel housing, approx. 9 3/8" long, mounted concealed within the ballast channel.
 6. Test switch and pilot light mounted on the ballast channel cover.
- C. Label emergency lighting power packs, using a black marking pen, with the identity of the un-switched circuit.

2.06 EMERGENCY EXIT LIGHTS

- A. Exit lights must conform to the following:
1. Furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.
 2. Meet or exceed the current NFPA requirements.
 3. Light emitting diode (LED) type.
 4. Die-cast aluminum.
 5. Concealed and removable directional chevron knock-outs.
 6. Stencil face.
 7. Red letter color.
- B. Label power packs, using a black marking pen, with the identity of the un-switched circuit.

2.07 METAL HALIDE FIXTURES

- A. Metal halide downlights must conform to the following:
1. Galvanized steel frame with adjustable hangers.
 2. Outdoor and wet area fixtures shall have flat tempered glass lens with gaskets.
 3. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.
- B. High and low bay light fixtures must conform to the following:
1. Die-cast aluminum housing.
 2. Pendant splice box which allows the fixture housing to slide on.
 3. Enclosed glass reflector for high bay
 4. Enclosed acrylic reflector for low bay.
 5. Porcelain, mogul lamp socket of copper alloy with nickel plated screws, shell and center contact.

RESTROOM BUILDING

6. Full wire-guard, 2 piece, to protect the lens and the reflector.
 7. Safety chain.
 8. Outdoor and wet area fixtures shall have gaskets.
- C. Recessed squares (2 X 2, T-bar and non-T-bar mounted) must conform to the following:
1. Steel housing.
 2. Earthquake clips.
 3. Flush steel door frame with metal rotary action latches.
 4. Flat tempered prismatic glass lens.
 5. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.

2.08 HIGH INTENSITY DISCHARGE BALLAST

- A. All metal halide ballasts must conform to the following:
1. Field replaceable without the need of special tools.
 2. Core and coil, lag type, high reactance, autotransformer, high power factor ballasts for 50-150 watt ballast.
 3. Core and coil, constant wattage, autotransformer, high power factor ballasts for 175-1500 watt ballast.
 4. All ballast must conform with ' Energy Independence and Security Act 2007'.
- B. Library ballast shall achieve an "A" sound rating.

2.09 LAMPS

- A. Incandescent lamps shall be rated at 130 volt and have medium, screw, brass bases.
- B. Linear and compact fluorescent lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins.
- C. Mogul base HID lamps are preferred over medium bases.

2.09 LED LIGHT FIXTURE

- A. Power supplies must use Constant Current Reduction (CCR) for dimming.
- B. LED lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins for interior fixtures and 4100 Kelvins for exterior fixtures or as specified on drawings.
- C. Lamp life of minimum of 60,000 hours or as specified.
- D. Fixtures must be supplied with multiple power supplies for multi-level switching when specified.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set luminaries true, free of light leaks, warps, dents or other irregularities. Provide the length of stems as required to hang all luminaries level and in the same plane. **VERIFY THE TYPE OF ALL CEILINGS BEFORE ORDERING FIXTURES, AND PROVIDE FIXTURES AND MOUNTINGS TO SUIT.** Mount all fixtures at a position and height to clear equipment, ductwork, piping, etc., in mechanical rooms, storage rooms, etc. Provide appurtenances for all light fixtures, which include stud supports, stems, mounting brackets, frames and plaster rings.
- B. Support luminaries only from structural elements which are capable of carrying the total weight. Mount all lighting fixtures rigid with no rocking action. Provide 13/16" channels as needed.
- C. The locations of all lighting fixtures as shown are approximate. It is understood that they are subject to such modifications as may be found necessary or desirable at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.
- D. Install ballasts and fixtures in accordance with the NEC and ANSI Standards.
- E. Adjust all floodlights and spotlights to the satisfaction of the Engineer.
- F. Connect all exit lighting fixtures to the nearest unswitched circuit or the nearest emergency circuit. Connect all emergency lighting fixtures to same circuit as normal area lighting in same area per NEC Article 700
- G. Provide and install necessary hardware and accessories to maintain 1.5 inches clearance from combustible material on all light fixtures with ballast.
- H. Provide all exit signs with required directional arrows, to indicate direction of egress travel.
- I. **Fixtures shall NOT be daisy chained together.**
- J. Troffer (lay-in) lighting fixtures shall be supported from the building structure by a minimum 12 gage galvanized carbon steel soft temper hanger wires. Install two hangers at diagonally opposite corners of each lay-in light fixture 2'x4' or smaller and one hanger at each corner of each lay-in light fixture larger than 2'x4'. Supporting of light fixtures from ceiling system is not acceptable.
- K. Each recessed lighting fixture shall be separately connected to a junction box with a flexible wiring method (i.e. daisy chaining from fixture to fixture is not allowed). The flexible conduit from the junction box to the fixture shall not lay on the ceiling as finally installed and shall not exceed 6 feet in length.
- L. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.
- M. Pendant mounted light fixtures shall be provided with 3/4", threaded, rigid metal conduit, painted to match the fixture color.

RESTROOM BUILDING

- N. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface, provide gaskets as needed.
- O. Install high or low bay light fixtures between the joist with the bottom of the reflector flush with the bottom cord of the joist. Engineer will direct if obstructions such as ducts, beams, etc. are permanently installed below the joist.
- P. Locate mechanical, electrical, equipment, etc. room light fixtures to provide the best coverage and clear all obstructions such as ducts, piping, bracing and supports.
- Q. Fluorescent High Bay are to be rigidly mounted with all thread, $\frac{3}{4}$ " threaded rigid metal conduit and unistrut as required.

3.02 CLEAN UP

- A. Leave all fixtures in clean condition, free of dirt and defects.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all exterior lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown. Exterior lights shall be circuited through lighting contactor for time clock/photocell control.

1.02 STANDARDS

- A. Provide all materials and accessories, whether specifically described or not, of the best grade of commercial manufacturer. Provide first class workmanship in every respect.
- B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures will not be acceptable.
- C. Manufacture lighting fixtures in accordance with the National Electrical Code.
- D. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania.

1.03 ACCEPTABLE LIGHTING PACKAGES:

- A. Lithonia
- B. Thomas Daybrite
- C. Hubbell
- D. Others as scheduled or noted

1.04 SUBMITTALS

- A. Furnish Engineer shop drawings for each fixture.
- B. Provide shop drawing which includes the following information:
 - 1. Fixture type per the fixture schedule
 - 2. Manufacturer of the fixture
 - 3. Physical dimensions of the fixture
 - 4. Manufacturer's standard finish
 - 5. Lamp type recommended by the manufacturer
 - 6. Fixture output distribution curves and photometrics
 - 7. Ballast temperature rating, voltage, wattage, and manufacturer
 - 8. Material type of lens

RESTROOM BUILDING

- C. Furnish structural engineer with approved shop drawings on pole, post and Bollard light fixtures for purpose of designing fixture base.

1.05 PRODUCT STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide luminaire complete with the fixture housing, refractor, lamp, and ballast.
- B. Provide type, wattage, and voltage lamp designated on Drawings.
- C. Where indicated on Drawings, provide parking lot poles and floodlight poles.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Orient lighting fixtures as shown on Drawings.
- B. Adjust all floodlights and spotlights to the satisfaction of the Engineer.
- C. Coordinate exact location of lighting fixtures with Architect prior to rough-in.

3.02 CLEAN UP

- A. Leave all fixtures and poles in clean condition, free of dirt and defects.

END OF SECTION